
Fourteen New Species of *Gonolobus* (Apocynaceae, Asclepiadoideae) from Mexico and Central America

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ABSTRACT. Fourteen new species of the genus *Gonolobus* (Apocynaceae, Asclepiadoideae) from Mexico and Central America are described and illustrated. *Gonolobus asterias*, *G. hammelii*, *G. truncatifolius*, *G. ustulatus*, and *G. variabilis* are endemic to Costa Rica. *Gonolobus grayumii* is from Costa Rica and adjacent Panama and *G. hadrostemma* is from Costa Rica and adjacent Nicaragua. *Gonolobus albiflorus*, *G. croceus*, and *G. sandersii* are from western Mexico. *Gonolobus pallidus* is from southern Mexico and *G. exannulatus* is from southern Mexico and Guatemala. *Gonolobus ancoriferus* is found in southeastern Mexico and Honduras and *G. cuajayote* is found in southern Mexico, El Salvador, and Nicaragua.

RESUMEN. Se describen e ilustran catorce nuevas especies del género *Gonolobus* (Apocynaceae, Asclepiadoideae) de México y Centroamérica. *Gonolobus asterias*, *G. hammelii*, *G. truncatifolius*, *G. ustulatus*, y *G. variabilis* son especies endémicas de Costa Rica. *Gonolobus grayumii* es de Costa Rica y Panamá y *G. hadrostemma* es de Costa Rica y Nicaragua. *Gonolobus albiflorus*, *G. croceus*, y *G. sandersii* son del oeste de México. *Gonolobus pallidus* es del sur de México y *G. exannulatus* es del sur de México y Guatemala. *Gonolobus ancoriferus* se encuentra en el sureste de México y en Honduras y *G. cuajayote* se encuentra en el sur de México, El Salvador y Nicaragua.

Key words: Apocynaceae, Asclepiadoideae, *Gonolobus*, Mesoamerica, Mexico.

Gonolobus is a genus of about 150 species ranging from the southern U.S.A. to Argentina and the Caribbean, with one species introduced in western tropical Africa. The greatest diversity is centered in southern Mexico and Central America, where a number of species remain to be described. This contribution continues the effort (Stevens & Montiel, 2002, 2004) to account for the known but undescribed species, now about half completed. To

facilitate the description of individual species, a description of the genus is provided.

Gonolobus Michaux

Twining (*dextrorsum externe visus*) herbaceous or woody vines, corky bark absent from woody stems, stems nearly glabrous to variously pubescent, hairs of uniform length or more often a mixture of long hairs and short and/or short capitate-glandular hairs, indumentum of internodes uniform or arranged in 1 or 2 lines beginning between leaf axils and ending at leaf axils; latex white; roots fibrous. Leaves opposite, without pseudostipules, petiolate, with colleters at adaxial union of blade and petiole, lateral veins pinnate. Inflorescence extra-axillary, 1 per node or rarely with a second inflorescence borne on an axillary short shoot, racemiform or paniculiform; calyx divided nearly to base, normally with colleters within below the sinuses; corolla rotate, campanulate with a rotate limb, or occasionally tubular, aestivation imbricate and dextrorse, mostly with a faucal annulus around corona, hairs of inside of corolla unicellular; androecium and gynostegium entirely fused and forming a gynostegium; corona gynostegial, of 5 largely connate lobes, adnate to base of gynostegium and to corolla; anthers indistinct, completely adnate to style apex, normally with a laminar or fleshy appendage on distal-dorsal margin, terminal appendages appressed to margin of style apex, guide rails linear, often indistinct, \pm vertical or tilted under base of gynostegium; pollinaria \pm horizontal, along anther margin, corpusculum mostly sagittate, translator prominently translucent-winged, pollinia symmetrically or mostly asymmetrically obovoid, rarely cylindrical, with proximal part sterile and \pm excavated; style apex pentagonal or \pm star-shaped, shallowly concave, smooth or rugose. Follicles 1 or 2, base asymmetrical, borne at 90° – 180° to pedicel, mostly with 5 complete wings, occasionally with fewer and/or incomplete wings or rarely without wings, smooth to tuberculate; seeds numerous, obovate, flat, with a prominent margin, comose.

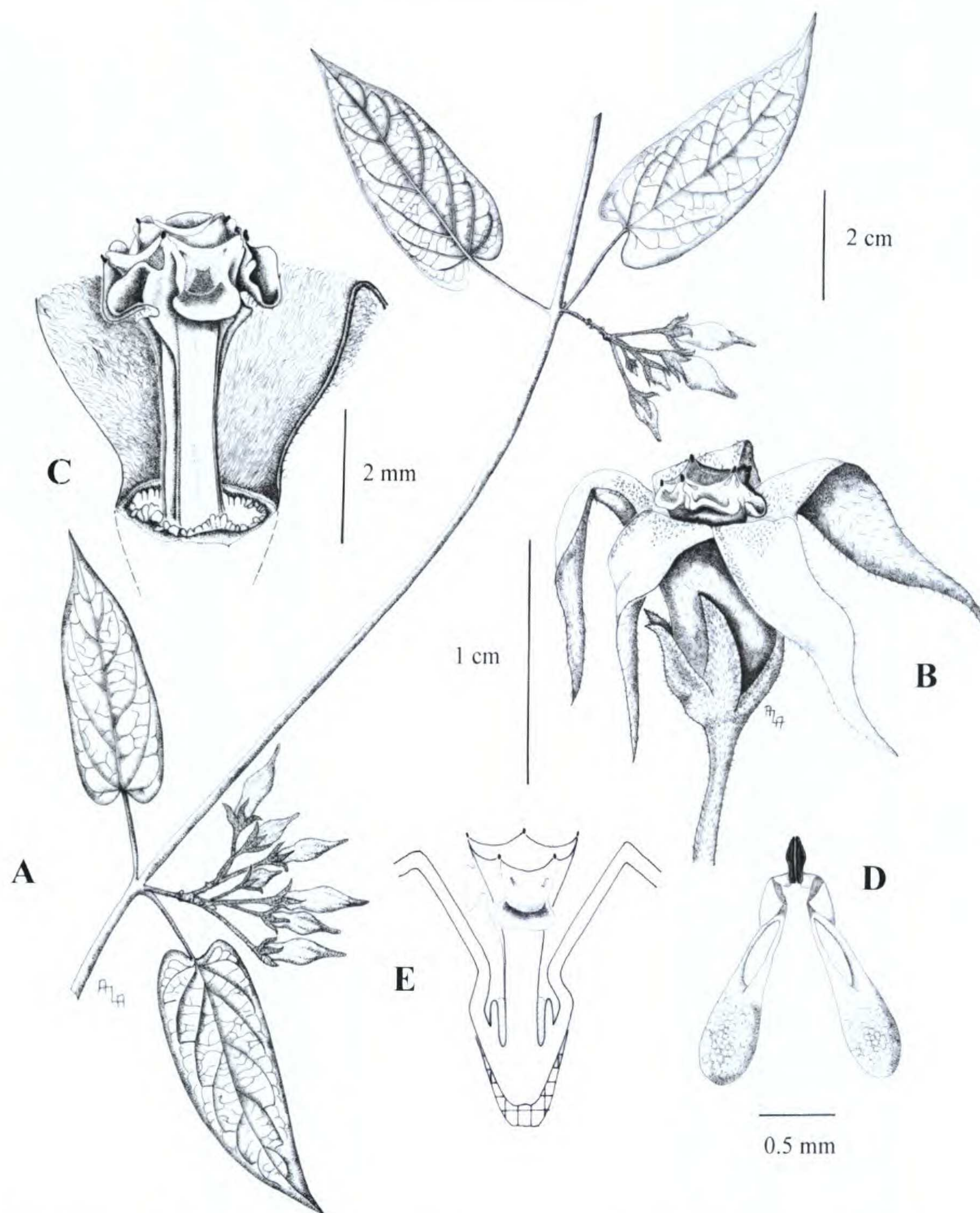


Figure 1. *Gonolobus albiflorus* W. D. Stevens. —A. Flowering branch. —B. Flower. —C. Gynostegium. —D. Pollinarium. —E. Diagnostic longitudinal section of flower. Drawn from Stevens *et al.* 2554 (MO).

1. ***Gonolobus albiflorus*** W. D. Stevens, sp. nov.
TYPE: Mexico. Jalisco: Mpio. Tuxpan, lower E slope of Nevado de Colima, ca. 1 mi. above Fresnito, 28 July 1976, W. D. Stevens, M. J. Donoghue & M. L. Scott 2554 (holotype, MO; isotypes, ENCB, MSC). Figure 1.

Gonolobo gonoloboidi affinis sed floribus minoribus tubo corollae angustiore gynostegio exserto.

Perennial parts unknown, young stems densely white-pilose, hairs spreading to somewhat reflexed, 0.3–1.1 mm long, internodes 10–15 cm. Leaf blades ovate-elliptic, 5.4–8.5 × 1.8–3.8 cm, apex attenuate, base lobate, lobes descending, sinus 0.4–0.8 cm deep, ± densely glassy-pilose, hairs

0.4–1.0 mm long, lateral veins 4 to 6 pairs, middle veins 45°–55° to midrib, collectors 2 to 4; petiole 1.7–4 cm, densely white-pilose. Inflorescence congested-racemiform to paniculiform (twice-branched), 1- to 40-flowered, densely white-pilose, peduncle 2–11 mm, axis 0.5–11 mm, pedicel 9–17.5 mm, bracts 1.4–2.5 × 0.1–0.2 mm, linear; calyx tube 0.5–1.5 mm long, with 1 collector per sinus, lobes elliptic to deltate with acute to attenuate tips, 4.5–6.4 × 1–1.4 mm, green or tinted purple, pilose outside, glabrous inside except tip pilose; corolla tubular, constricted in middle (above corona), uniformly white or tinted purple at base outside, tube 6–8.8 mm long, pilose outside with hairs 0.3–0.4 mm long except glabrous at base, in-

side white-velutinous with reflexed hairs 0.4–0.8 mm long except base glabrous, faucal annulus absent, lobes deltate to lanceolate with acute to attenuate tips, $9.5\text{--}12.5 \times 2.6\text{--}3.4$ mm, reflexed, pilose outside with hairs 0.3–0.4 mm long, inside glabrous except with curly, white hairs ca. 0.1 mm long in a dense fringe along the proximal half or two-thirds of one side and in a small triangle at base; gynostegium with stipe $5.5\text{--}6.3 \times 0.6\text{--}1.3$ mm, prominently 5-winged, each wing with a tooth near top, corona an erect, fluted, glabrous ring 1.2–1.5 mm long, adnate for most of length to corolla, anther appendages \pm deflexed, spatulate, concave above, $1\text{--}1.6 \times 0.9\text{--}1.6$ mm in outline, fleshy, purple, terminal appendages tightly appressed to style apex, $0.1\text{--}0.2 \times 1.2\text{--}1.4$ mm, purple, guide rails straight, parallel, indistinct, $0.6\text{--}1.5 \times 0.1\text{--}0.2$ mm; corpusculum $0.3\text{--}0.39 \times 0.11\text{--}0.13$ mm, sagittate, dark brown, translators $0.35\text{--}0.38 \times 0.15\text{--}0.18$ mm, pollinia $1.02\text{--}1.08 \times 0.3\text{--}0.33$ mm; style apex 2.8–3.4 mm wide, yellow-green. Fruits and seeds unknown.

This species belongs, with *Gonolobus gonoloboides* (Greenman) Woodson and *G. arizonicus* (A. Gray) Woodson, in *Gonolobus* subg. *Pseudolachnostoma* Woodson, characterized by campanulate to tubular, white corollas without faucal annuli, relatively short coronas that do not line the inside of the corolla tube, and gynostegia with long stipes. This new species is easily distinguished from the other two by relatively narrower, reflexed corolla lobes, a relatively narrower corolla tube, and an exserted gynostegium. *Gonolobus albiflorus* seems to be restricted to a small area of the eastern slopes of the Nevado de Colima, Mpio. Tuxpan, Jalisco, Mexico, between 2000 and 2100 m elevation. It is known to flower in July and August.

Paratypes. MEXICO. **Jalisco:** Mpio. Tuxpan, 11 km al O de la carr. Atenquique–Colima, brecha al Playón, *J. Villa C.*, *S. D. Koch & J. Chávez L.* 861 (CHAPA, MO); antenas de microondas de Cerro Alto, 1 km al S de Atenquique, carr. a Colima, luego 14 km al O por brecha al Volcán de Colima y al Cerro Alto, *M. Fuentes O.* 547 (CHAPA, MO).

2. *Gonolobus ancoriferus* W. D. Stevens, sp. nov. TYPE: Honduras. Yoro: 0.9 km E of San José Texiguat by road, then 3.5 km up Río Texigua, N of Cerro Cabeza de Negro, $15^{\circ}29'N$, $87^{\circ}27'W$, 200–300 m, 22 Apr. 1994, *A. E. Brant & D. Hazlett* 2904 (holotype, MO; isotype, EAP). Figure 2.

Gonolobo xanthotricho affinis, a qua imprimis differt corona annulo 2–3plo longiore.

Perennial parts unknown, young stems with mixed indumentum, denser at the nodes, long hairs spreading or somewhat reflexed, pale yellow to brown, 0.5–2.5 mm long, short and glandular hairs white to dark brown, 0.05–0.15 mm long, internodes 5–24 cm. Leaf blades elliptic to oblong, $7.1\text{--}13.6 \times 2.8\text{--}5.7$ cm, apex acuminate, base rounded, truncate or shallowly lobate, lobes divergent to descending, sinus to 0.4 cm deep, adaxially glabrous or with sparse, appressed hairs 0.3–0.4 mm long, abaxially hispidulous with hairs 0.2–0.3 mm long, lateral veins 6 to 9 pairs, middle veins $60^{\circ}\text{--}70^{\circ}$ to midrib, colleters 2 or 3; petiole 1.1–2.7 cm, pilose. Inflorescence congested-racemiform, 2- to 16-flowered, peduncle 1–9 mm, glabrous or with sparse mixed indumentum, axis 2–7 mm, pedicel 17–37 mm, with dense mixed indumentum, bracts $1\text{--}1.5 \times 0.2\text{--}0.3$ mm, lanceolate or deltate; calyx tube 0.4–1 mm long, with 1 colleter per sinus, lobes lanceolate with acute tips, $5.3\text{--}6.4 \times 2\text{--}2.4$ mm, green or with purple or brown margins, abaxially hispidulose with hairs 0.2–0.9 mm long, adaxially glabrous; corolla rotate, green or yellow-green, apparently sometimes with red or purple markings, tube 2.2–3 mm long, glabrous, faucal annulus an erect tube, entire or inconspicuously 5-lobed, 0.5–1.1 mm tall, upper margin with a fringe of erect white hairs 0.6–1.5 mm long, corolla lobes ligulate, with thickened margins, nearly valvate, distally cucullate (tips inflexed in bud) and deeply rugose, apex rounded when flattened but strongly folded and contorted, glabrous inside, hispidulous outside with hairs 0.2 mm long or sometimes nearly glabrous, $6\text{--}8 \times 3.2\text{--}4.3$ mm, patent; gynostegium with stipe $1.5\text{--}2.1 \times 0.4\text{--}1.4$ mm, smooth or slightly 5-ribbed, corona fleshy, yellow-orange, bowl-shaped, 2.3–3 mm tall, 5-lobed, lobes angular, slightly retuse or entire, base adnate to annulus, anther appendages bifid, stalk patent, $0.9\text{--}1.2 \times 0.6\text{--}0.8$ mm, arms twisted and arching upward, $1.3\text{--}2 \times 0.3\text{--}0.5$ mm, tips of arms 2.5–4 mm apart, terminal appendages appressed to style apex, $0.2\text{--}0.3 \times 1.6\text{--}2$ mm, apparently white, guide rails straight, parallel, indistinct, ca. 0.15×0.1 mm; corpusculum $0.21\text{--}0.25 \times 0.13\text{--}0.15$ mm, sagittate, red-brown, translators $0.28\text{--}0.36 \times 0.15\text{--}0.19$ mm, pollinia $1.04\text{--}1.31 \times 0.43\text{--}0.46$ mm, symmetrical or slightly asymmetrical; style apex 2.3–3 mm wide. Fruits and seeds unknown; ovaries 5-ribbed, glabrous.

This new species is most similar to *Gonolobus xanthotrichus* Brandege, but most conspicuously is much less pubescent overall, the corolla lobes are never barbate within, the dorsal anther appendages

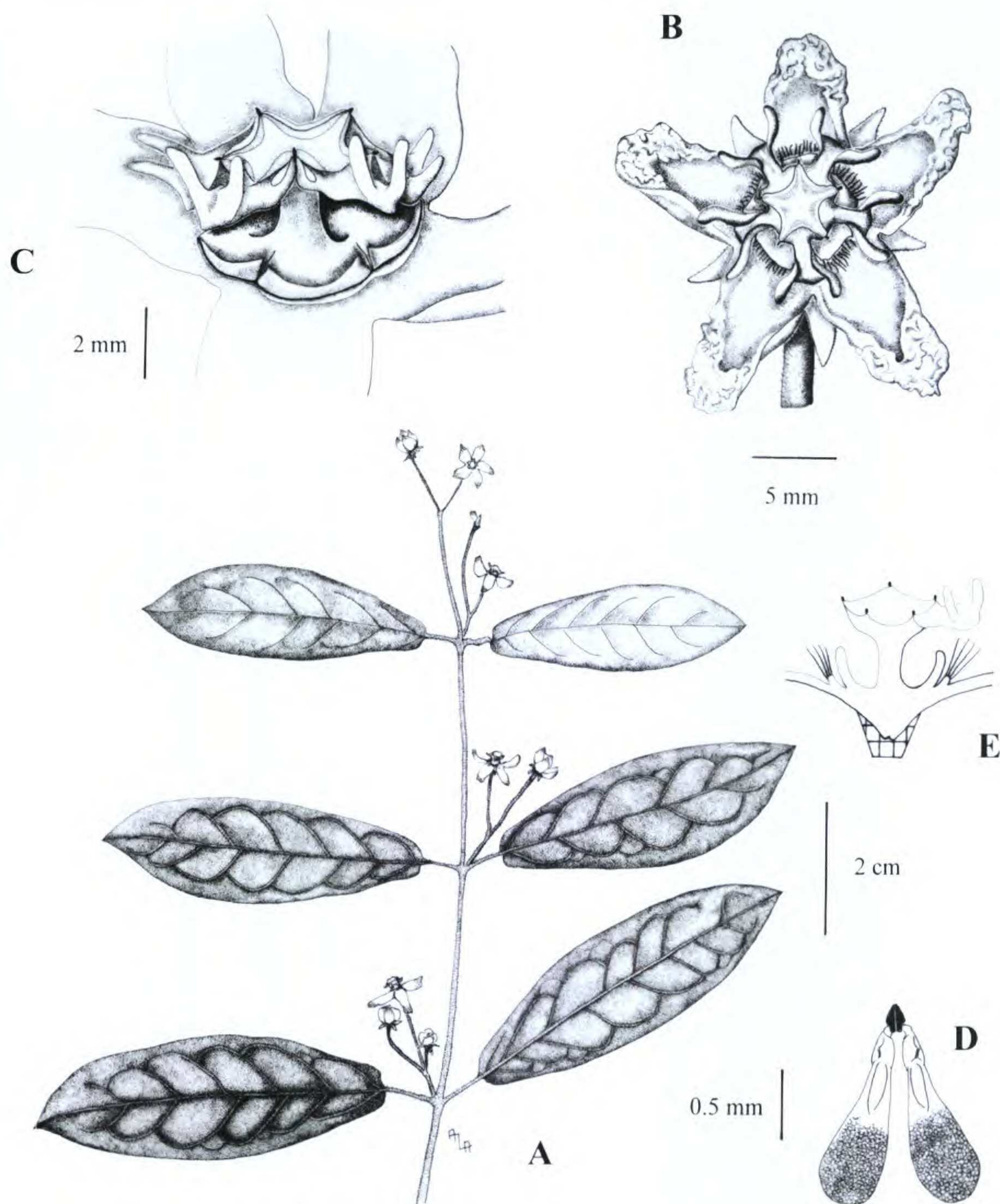


Figure 2. *Gonolobus ancoriferus* W. D. Stevens. —A. Flowering branch (Hernández 1085, MO). —B. Flower (Martínez & Soto 18643, MO). —C. Gynostegium (Martínez & Soto 18643, MO). —D. Pollinarium (Martínez & Soto 18643, MO). —E. Diagnostic longitudinal section of flower.

are longer and thinner, and the corona is two to three times longer than, rather than shorter than to equaling, the faucal annulus. This species has a relatively large distribution but seems to be uncommon; it has been found from sea level to 700 m and is known to flower from March to June.

Paratypes. MEXICO. **Veracruz:** Mpio. Catemaco, Playa Escondida, 10 km N of Sontecomapan, *M. Nee* 26692 (F, MO, NY, XAL); Mpio. San Andrés Tuxtla, Playa Balzapote, *R. Cedillo T.* 3577 (MO). **Oaxaca:** Dpto. Juchitán, Mpio. Santa María de Chimalapa, Juyupac, 2.5 km al N de Santa María, *H. Hernández G.* 1085 (CAS, MO). **Chiapas:** Mpio. Ocosingo, El Tumbo, camino Chancala-Monte Líbano, *E. Martínez S. & M. A. Soto A.* 18643 (F, MEXU, MO).

3. *Gonolobus asterias* W. D. Stevens, sp. nov.

TYPE: Costa Rica. San José: basin of El General, May 1940, *A. F. Skutch* 4938 (holotype, US; isotypes, CR, F, NY). Figure 3.

Amplitudine et forma florum *Gonolobo versicolori* similis, praecipue differt calyce majore lobis corollae longioribus latioribus attenuatioribus ecarnosis.

Perennial parts unknown, young stems with mixed indumentum, most densely at the nodes and in 2 lines on internodes, long hairs ferrugineous, somewhat reflexed, 0.7–0.9 mm long, short and glandular hairs 0.04–0.06 mm long, internodes 4–8 cm. Leaf blades elliptic, 6.2–7.2 × 3.9–4.6 cm,

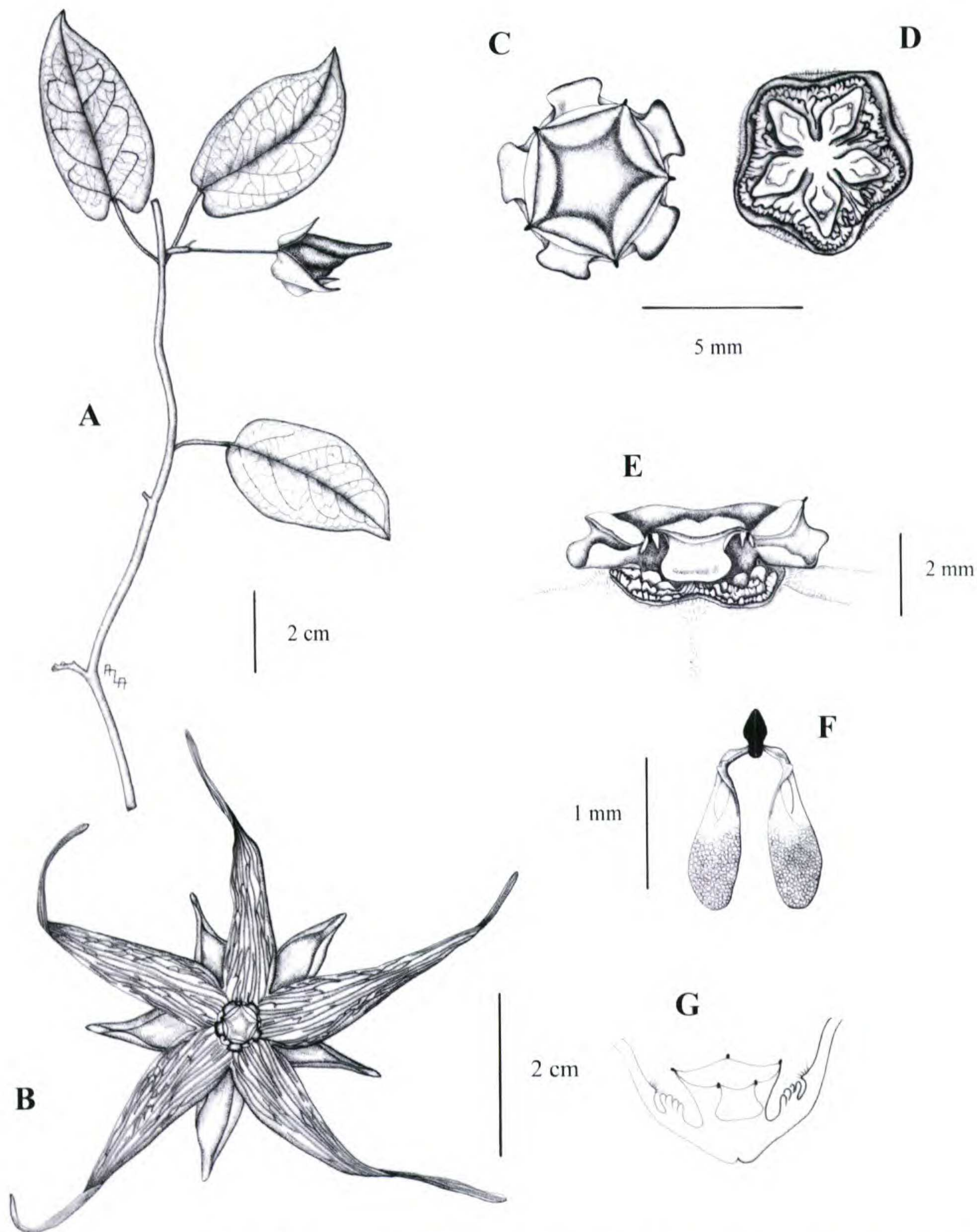


Figure 3. *Gonolobus asterias* W. D. Stevens. —A. Flowering branch. —B. Flower. —C. Gynostegium from above. —D. Corona and faucal annulus, from above with gynostegium removed. —E. Gynostegium, corona, and faucal annulus, from side. —F. Pollinarium. —G. Diagnostic longitudinal section of flower. Drawn from holotype, *Skutch 4938* (US).

apex abruptly acuminate, base lobate, lobes descending, sinus 0.2–0.4 cm deep, sparsely appressed-puberulent with hairs 0.1–0.2 mm long, lateral veins 5 to 7 pairs, middle veins 55° – 60° to midrib, colleter 2, black with pale tips; petiole 1.9–2.7 cm, with short and glandular hairs, mostly on adaxial side and distally. Inflorescence congested-racemiform, 3- to 4-flowered, glabrous, peduncle 2–8 mm, axis 3–6 mm, pedicel ca. 45 mm, bracts 4–11 \times 1.2–1.8 mm, lanceolate; calyx tube

ca. 0.5 mm long, with 1 to 2 colleter per sinus, lobes lanceolate-attenuate with acute tips, 13–16 \times 4.5–5.5 mm, green or tinted purple, glabrous or appressed-puberulent on distal margin; corolla rotate, green, glabrous except puberulent on faucal annulus and in lines from annulus to corolla sinuses, hairs erect, translucent, 0.1–0.2 mm long, tube 4–4.5 mm long, faucal annulus pentagonal in outline, of 5 erect lobes opposite corolla sinuses connected by a thin line, lobes deltate, ca. 0.4 mm tall,

corolla lobes lanceolate-attenuate with acute tips, $35\text{--}40 \times 6\text{--}8$ mm, apparently patent; gynostegium essentially sessile, corona a pentagonal disk, $1.3\text{--}1.6$ mm wide, densely papillate, deeply rugose except 5 smooth patches, each smooth patch with a raised, fleshy cushion, anther appendages somewhat deflexed, somewhat bilobed, $0.8\text{--}0.9 \times 2\text{--}2.2$ mm in outline, laminar, terminal appendages tightly appressed to margin of style apex, ca. 0.3×2.7 mm, apparently translucent, guide rails straight, parallel, indistinct, ca. 0.1×0.1 mm, essentially horizontal under style apex; corpusculum ca. 0.38×0.16 mm, sagittate, pale brown, translators ca. 0.34×0.16 mm, pollinia ca. 1.23×0.48 mm; style apex ca. 4.7 mm wide. Fruits and seeds unknown.

This is a remarkable new species that in the years since its only collection, in 1940, has twice been supplied with manuscript names, but neither formal description was consummated. In floral morphology it is closest to *Gonolobus versicolor* Woodson and somewhat less so to *G. cteniophorus* (S. F. Blake) Woodson. Williams (1968) associated *Gonolobus breedlovei* L. O. Williams and *G. longipetiolatus* Woodson (= *G. salvinii* Hemsley) with *G. versicolor*, but I consider neither to be closely related. On the the other hand, there are at least two other undescribed Mexican species that share the very long and narrow corolla lobes, more or less entire dorsal anther appendages, and a discoid, deeply fimbriate corona.

Gonolobus asterias was found in a well-collected area of the best-known country in the American tropics. Since its large flowers would not be easily overlooked, especially not by the keen Costa Rican collectors, this species might well be extinct.

4. *Gonolobus croceus* W. D. Stevens, sp. nov.

TYPE: Mexico. Sinaloa: Colomas, July 1897, J. N. Rose 1717 (holotype, MO; isotypes, GH, US). Figure 4.

Gonolobo jaliscensi primo aspectu maxime simile, sed foliis fere glabris floribus 2–3plo majoribus corolla praeter annulum hirsutum glabra.

Perennial parts unknown, young stems glabrous or sparsely tomentose, especially at nodes, hairs $0.1\text{--}0.3$ mm long, white or tinted red, internodes $11\text{--}16$ cm. Leaf blades elliptic, lanceolate or narrowly obovate, $6.4\text{--}9.4 \times 1.7\text{--}2.3$ cm, apex acute to attenuate, base lobate to truncate, lobes descending to divergent, sinus to 0.4 cm deep, glabrous or sparsely pilose on midrib and margin, hairs $0.2\text{--}0.3$ mm long, lateral veins indistinct, 5 to 8 pairs, middle veins $40^\circ\text{--}60^\circ$ to midrib, collectors 2 to 6;

petiole $1.1\text{--}1.6$ cm, glabrous or sparsely pilose. Inflorescence congested-racemiform, 1- to 8-flowered, peduncle $2\text{--}11$ mm, glabrous or sparsely pilose in 1 line, axis $0.5\text{--}3$ mm, pedicel $8\text{--}16$ mm, sparsely pilose in 1 line, bracts $0.7\text{--}1 \times 0.1\text{--}0.2$ mm, linear to lanceolate; calyx tube $0.2\text{--}0.5$ mm long, with 1 to 2 collectors per sinus, lobes elliptic with acute tips, $2.9\text{--}4 \times 1.2\text{--}1.4$ mm, green or tinted purple, glabrous or sparsely pilose at base outside and on margin; corolla tubular in basal half of connate part, then rotate, yellow (Cowan & Nieves 4785), drying yellow-green with deep green veins on base of corolla lobes, tube (connate part of corolla) $2.6\text{--}3.6$ mm long (erect, tubular part $1\text{--}1.3$ mm, reflexed part $1.6\text{--}2.6$ mm), glabrous except on faucal annulus, faucal annulus erect, somewhat pentagonal in outline, densely hispid with erect, glassy hairs $0.15\text{--}0.4$ mm long, lobes elliptic with obtuse tips, $5.5\text{--}7.2 \times 3.2\text{--}4.3$ mm, reflexed, glabrous outside, inside glabrous except sparsely white-papillose on basal half; gynostegium with stipe $0.7\text{--}0.8 \times 0.7\text{--}0.8$ mm, 5-ribbed, corona an erect, fluted, somewhat pentagonal, glabrous ring ca. 0.5 mm tall, anther appendages patent or somewhat deflexed, broadly spatulate, $0.4\text{--}0.7 \times 1\text{--}1.4$ mm in outline, fleshy, apparently white, terminal appendages tightly appressed to style apex, $0.2\text{--}0.4 \times 1.1\text{--}1.5$ mm, apparently translucent, guide rails straight, parallel, indistinct, $0.15\text{--}0.3 \times 0.05\text{--}0.13$ mm, essentially horizontal under style apex; corpusculum $0.17\text{--}0.18 \times 0.07\text{--}0.08$ mm, sagittate, dark brown, translators $0.3\text{--}0.35 \times 0.17\text{--}0.18$ mm, pollinia $0.6\text{--}0.7 \times 0.22\text{--}0.3$ mm; style apex $2.3\text{--}2.6$ mm wide, apparently greenish white. Fruits and seeds unknown.

The known collections of this species are from the Pacific foothills of the central coast of Mexico, at about 900 m elevation; flowers are recorded from May to July. It is a distinctive species, with relatively small and narrow, bicolorous, nearly glabrous leaves and small, nearly glabrous flowers. It shares the leaf size and shape, small flowers, similar dorsal anther appendages, and general geographic area with *Gonolobus jalicensis* B. L. Robinson & Greenman. However, that species is found generally further to the south, is densely pubescent throughout, and has green rather than yellow corollas with the inner face densely white-hispid.

Paratypes. MEXICO. **Nayarit:** Mpio. San Blas, 3 mi. E of Jalcatán, D. H. Norris & D. J. Taranto 13138 (MO); Mpio. Tepic, 17.7 km al O de Tepic (ruta 15) sobre ruta 28 (66), 7 km al O de Carranza, C. P. Cowan & G. Nieves H. 4785 (MO, TEX).

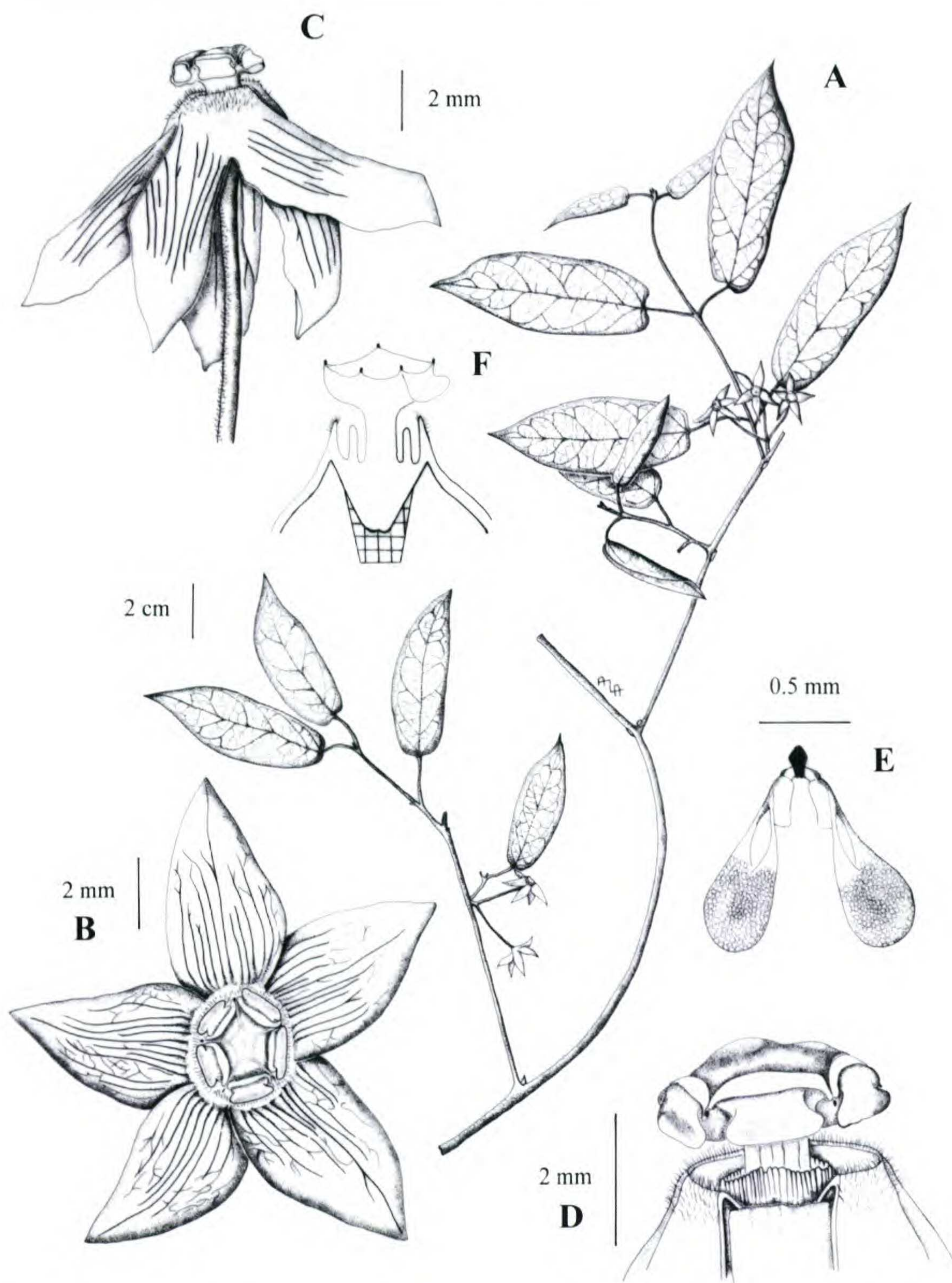


Figure 4. *Gonolobus croceus* W. D. Stevens. —A. Flowering branch (Rose 1717, MO). —B. Flower from above, flattened (Cowan & Nieves 4785, MO). —C. Flower from side (Norris & Taranto 13138, MO). —D. Gynostegium (Norris & Taranto 13138, MO). —E. Pollinarium (Rose 1717, MO). —F. Diagnostic longitudinal section of flower.

5. *Gonolobus cuajayote* W. D. Stevens, sp. nov.
 TYPE: Nicaragua. Managua: 2.3 km from Hwy. 12 on road along ridge of Sierra de Managua from Hwy. 12 at Km 17 to Hwy. 2, 12°04'N, 86°22'W, 450–550 m, 29 July 1977, W. D. Stevens 2932 (holotype, MO). Figure 5.

Ex *Gonolobo nigro* corolla viridi pedunculis brevioribus annulo saepe ciliato distinguenda.

Herbaceous or woody below, young stems with mixed indumentum, denser at the nodes and in 2 lines on internodes, long hairs absent or restricted

to nodes, spreading or somewhat reflexed, pale yellow, 0.3–0.7 mm long, short hairs white, 0.05–0.1 mm long, glandular hairs pale brown, ca. 0.05 mm long, internodes 2–15 cm. Leaf blades elliptic to ovate, 3.9–12.1 × 1.9–7 cm, apex acuminate, base lobate, lobes divergent to convergent, sinus 0.2–2 cm deep, adaxially glabrous to sparsely pilosulose with long hairs erect, 0.4–0.6 mm long, and short and glandular hairs on veins, abaxially with sparse mixed indumentum, lateral veins 5 to 7 pairs, middle veins 30°–40° to midrib, colleters 2 to 4; petiole 2.8–9.8 cm, with sparse mixed indumentum. Inflo-

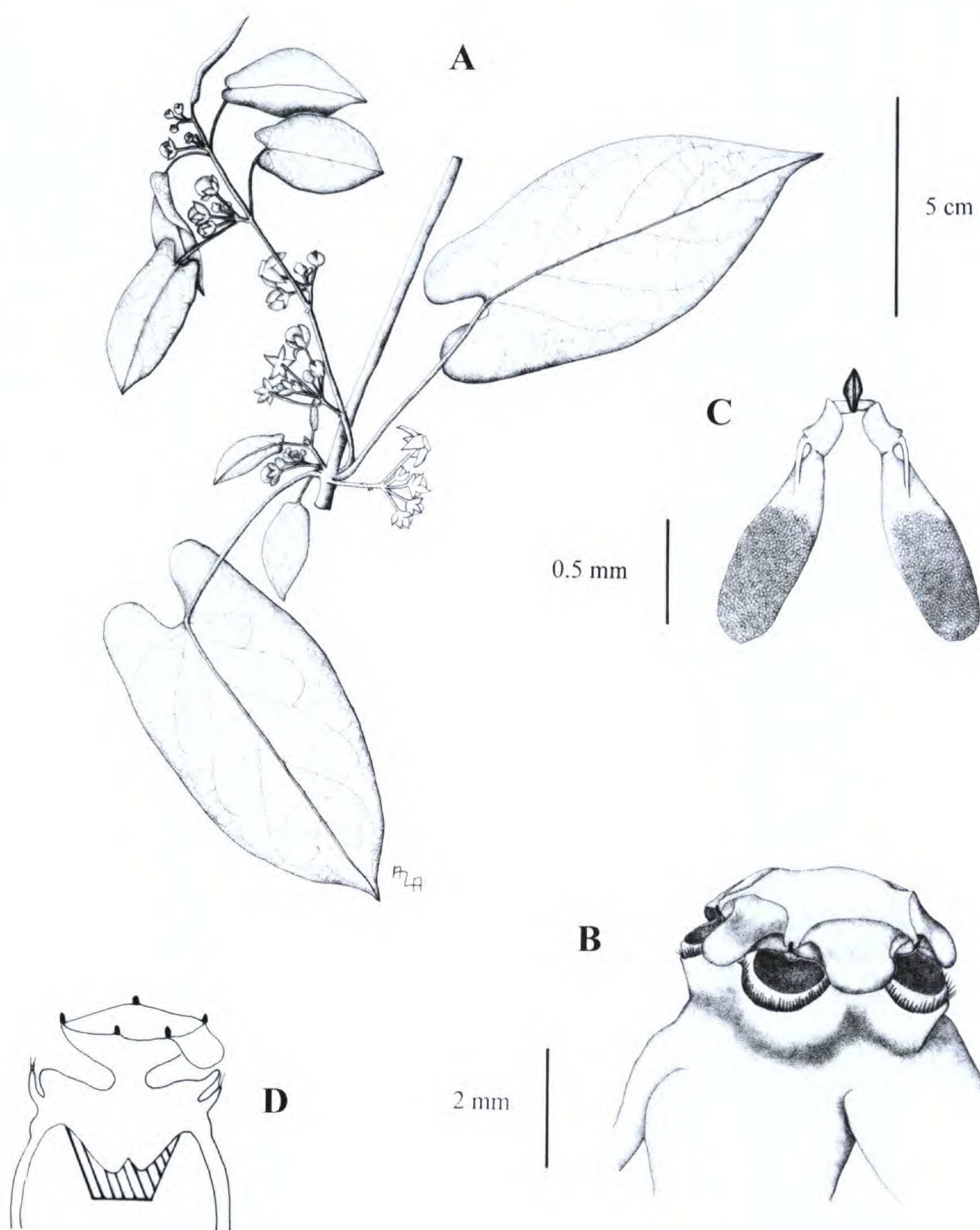


Figure 5. *Gonolobus cuajayote* W. D. Stevens. —A. Flowering branch (Stevens 2932, MO). —B. Flower from side (Stevens 2932, MO). —C. Pollinarium (Villacorta 587, MO). —D. Diagnostic longitudinal section of flower.

rescence 1 or rarely 2 per node, racemiform, 12- to 22-flowered, with mixed indumentum, peduncle (0-)15-22(-45) mm, axis 2-17 mm, pedicel 9-24 mm, bracts $1.1-2.2 \times 0.2-0.4$ mm, linear or deltate; calyx tube 0.7-1.7 mm long, with 1 colleter per sinus, lobes deltate with acute to rounded tips, $2.3-4 \times 1.3-2.2$ mm, bright green, abaxially glabrous or with sparse mixed indumentum on proximal half, adaxially glabrous; corolla rotate, deep green, abaxially densely hispidulose with short and glandular hairs 0.05-0.1 mm long, adaxially (except annulus) glabrous, tube 1.2-2.4 mm long, faucal annulus a membranous, erect lip, inconspicuously 5-lobed, 0.5-0.7 mm tall, upper margin glabrous or with a thin fringe of erect white hairs 0.2-0.3 mm long, corolla lobes lanceolate to ellip-

tic, apex acute to obtuse or rounded, with conspicuous to inconspicuous auricles at the sinuses, one margin of each lobe with a thin, dull white callus, $4-7 \times 3-4.2$ mm, strongly reflexed; gynostegium with stipe $0.4-0.7 \times 0.7-1.3$ mm, 5-winged, each wing with a small, fleshy projection near top, corona fleshy, yellow-orange, bowl-shaped, 5-lobed, 0.4-0.8 mm tall, 1.3-1.8 mm wide at lobes, 0.7-1.4 mm wide at sinuses, anther appendages deflexed, reniform to nearly spatulate, somewhat fleshy, smooth, orange, $1-1.2 \times 0.9-1.2$ mm, terminal appendages appressed to margin of style apex, $0.2-0.5 \times 1.8-2.4$ mm, white, guide rails indistinct, ca. 0.2×0.1 mm; corpusculum $0.22-0.28 \times 0.07-0.1$ mm, sagittate, tip slightly hooked, red-brown, translators $0.22-0.34 \times 0.12-0.15$ mm,

pollinia $1.02\text{--}1.2 \times 0.32\text{--}0.44$ mm, symmetrical or slightly asymmetrical; style apex 3–3.6 mm wide. Follicles ellipsoid, apex obtuse, base abruptly narrowed, doubled back against follicle body, ca. 10×5 cm, with 2 complete wings 5–6 mm wide and 3 distal wing fragments, glabrous; seeds obovate, $7\text{--}8 \times 4.3\text{--}4.55$ mm, brown with brown-black radial streaks, margin 0.5–0.6 mm wide, crenulate on distal half, surface smooth, coma 2–3 cm long, white.

This new species is most similar to *Gonolobus niger* (Cavanilles) R. Brown ex Schultes, ranging from northeastern Mexico to Guatemala, and *G. roeanus* L. O. Williams, endemic to Guatemala. *Gonolobus roeanus* differs from the other two most prominently by having a thick, fleshy faucal annulus (vs. membranous), calyx lobes exceeding the corolla lobes (vs. about half the length), and the corolla internally papillate (vs. smooth and glabrous). *Gonolobus cuajayote* is more similar to *G. niger* but differs most conspicuously in having green corollas with a white callus along one side of each lobe rather than deep purple-black corollas with concolorous calluses, shorter peduncles, and a faucal annulus that is sometimes ciliate at the top, rather than always glabrous. *Gonolobus cuajayote* has winged follicles, while those of *G. niger* are unwinged, although the follicles of both are generally similar in size and shape; the follicles of *G. roeanus* are unknown. *Gonolobus niger* is most often found on limestone, while *G. cuajayote* is apparently restricted to soils of recent volcanic cinders. Furthermore, in the southern (Mesoamerican) part of the range of *Gonolobus niger* it has been found at elevations of 750 to 1700 m, while *G. cuajayote* occurs up to 900 m, with only two collection above 455 m. The species flowers from July to October and the single mature fruit was collected in March. In *Flora de Nicaragua* (Stevens et al., 2001: 251), this species was described as "*Gonolobus* sp. C."

Most, if not all, species of *Gonolobus* have fruits that are eaten when young, either raw or cooked. Most of the recorded local names are some orthographic variant of cuajayote, talayote, or cuchamper, and one of the common forms is borrowed for the epithet of this species (cf. Greuter et al., 2000, Art. 23.2).

Paratypes. MEXICO. **Chiapas:** Mpio. Cintalapa, 5 km W of Rizo de Oro, *D. E. Breedlove* 36686 (CAS); Mpio. Esperanza, Contua, *E. Matuda* 18342 (F). EL SALVADOR. **Ahuachapán:** P.N. El Imposible, Finca San Alfonso, *R. Villacorta*, *R. Toledo* & *R. López* 853 (B, LAGU, MO). **La Libertad:** Volcán Caldera, *A. Monro*, *J. Monterossa* & *R. Carballo* 3786 (MO); Quezaltepeque, Río Sucio, El Platanillo, *R. Villacorta* 587 (B, LAGU, MO). NICA-

RAGUA. **Chinandega:** Volcán San Cristóbal, Hacienda Las Rojas, *A. Grijalva*, *D. Soza* & *H. M. Hernández* 3952 (MO); Los Balcones, 9 km de Somotillo, carr. a Cinco Pinos, *P. P. Moreno* 11509 (MO); 3–4 km al SE de San Pedro de Potrero Grande, Los Laureles, *P. P. Moreno* 11709 (MO); Carr. entre Cinco Pinos y San Francisco, *R. Rueda* & *R. Dolmus* 1180 (HULE, MO). **León:** S base of Volcán Telica, above Quimera, *H. H. Iltis*, *B. F. Benz* & *A. Grijalva* 30813 (MO, WIS). **Managua:** Reserva El Chocoyero, Sierra de Managua, *W. D. Stevens* & *O. M. Montiel* 26520 (HNMN, MO).

6. *Gonolobus exannulatus* W. D. Stevens, sp. nov. TYPE: Mexico. Chiapas: Mpio. Angel Albino Corzo, between Finca Cuxtepeque and Finca Cabañas, 1100 m, 9 May 1988, *D. E. Breedlove* & *M. Bourell* 67424 (holotype, CAS). Figure 6.

Species corolla alba omnino glabra rotata exannulata a congeneris distinguenda.

Perennial parts unknown, young stems with mixed indumentum \pm concentrated in 2 lines, long hairs patent to reflexed, pale yellow, 0.4–1.2 mm long, short and glandular hairs 0.03–0.15 mm long, internodes 1–18 cm. Leaf blades elliptic or somewhat ovate, $6.4\text{--}8.3 \times 3.3\text{--}5.4$ cm, apex acuminate, base lobate, lobes descending to diverging, sinus 0.3–0.8 cm deep, adaxially glabrous or with sparse appressed or erect hairs 0.2–0.4 mm long, abaxially with erect hairs 0.2–0.4 mm long, mostly on the nerves, lateral veins 5 to 6 pairs, middle veins $35^\circ\text{--}40^\circ$ to midrib, colleters 4; petiole 2.2–3.2 cm, with mixed indumentum. Inflorescence congested-racemiform, 2- to 12-flowered, with mixed indumentum, long hairs sparse, peduncle 3–12 mm, axis to 5 mm, pedicel 12–19 mm, bracts $1.2\text{--}1.5 \times 0.2\text{--}0.4$ mm, lanceolate; calyx tube 1–1.5 mm long, with 1 colleter per sinus, lobes elliptic to lanceolate with obtuse to rounded tips, $5.2\text{--}7.5 \times 3.1\text{--}3.5$ mm, green, glabrous or with a few hairs on abaxial base, patent with recurved tips; corolla very briefly campanulate at base and then rotate, white or pale green, entirely glabrous, tube 3.1–3.5 mm long, faucal annulus absent, lobes ovate with obtuse to rounded tips, $9.5\text{--}12.5 \times 5.2\text{--}6.1$ mm, patent with recurved tips, gynostegium with stipe ca. 1.3×2.5 mm, 5-winged, corona an erect, fleshy, 5-lobed bowl, with 5 radial ridges continuous with wings of stipe, 1.2–1.5 mm tall at lobes, 0.8–1 mm tall at sinuses, anther appendages somewhat deflexed, oblong to rounded-trapezoidal and retuse, fleshy, somewhat concave, $1.9\text{--}2.2 \times 2.8\text{--}3.4$ mm in outline, terminal appendages tightly appressed to style apex, $0.1\text{--}0.2 \times 2.2\text{--}2.4$ mm, apparently translucent, guide rails straight, parallel, $0.8\text{--}1 \times 0.1\text{--}0.2$ mm, nearly vertical; corpusculum $0.25\text{--}0.26 \times$

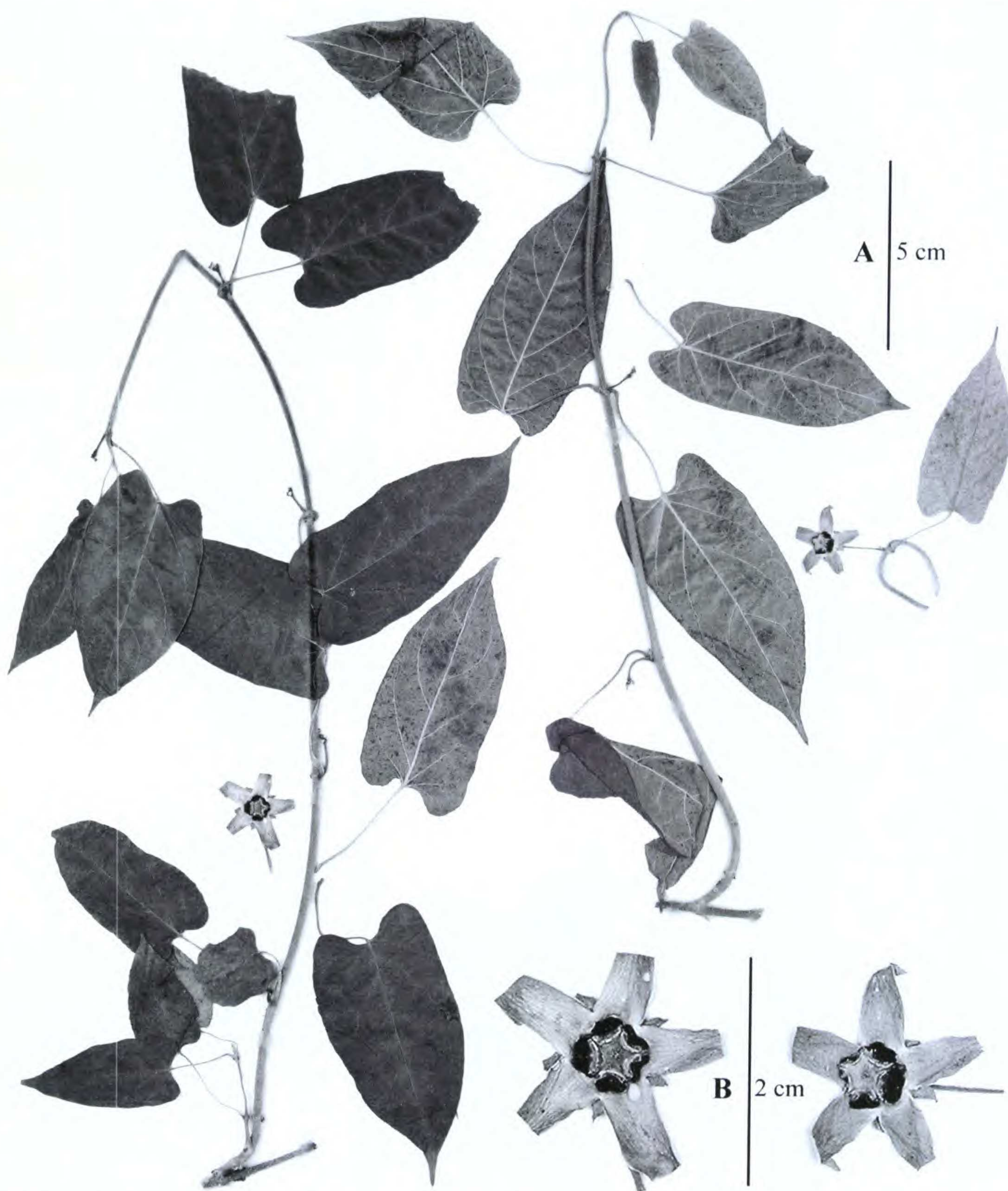


Figure 6. *Gonolobus exannulatus* W. D. Stevens. —A. Scan of holotype (*Breedlove & Bourell* 67424, CAS). —B. Close-up of flowers.

0.11–0.13 mm, sagittate, brown, translators 0.25–0.34 \times 0.18–0.19 mm, pollinia 1.53–1.65 \times 0.5–0.51 mm; style apex 3.7–4 mm wide. Fruits and seeds unknown, ovaries glabrous and 2-ribbed.

This new species, apparently known from four specimens, has an unusual set of characters. There are only a few species of *Gonolobus* with white or nearly white flowers, only a few that entirely lack a faucal annulus, only a few with an entirely gla-

brous corolla, and none other than this species with a combination of all three. The dark-colored anther appendages and corona contrast strikingly with the corolla. It has been collected at between 750 and 1500 m elevation and in flower in March and May.

Paratypes. GUATEMALA. **Guatemala:** near Finca La Aurora, *J. I. Aguilar* 251 (F). **San Marcos:** Finca El Porvenir, *J. A. Steyermark* 52310 (F). **Suchitepéquez:** near Pueblo Nuevo, *P. C. Standley* 66925 (F).



Figure 7. *Gonolobus grayumii* W. D. Stevens. —A. Scan of holotype (*Hammel & Grayum 14096*, MO). —B. Close-up of flowers.

7. *Gonolobus grayumii* W. D. Stevens, sp. nov.
 TYPE: Costa Rica. Heredia: just S of Vara Blanca on road to San Miguel, 10°09'N, 84°10'W, 1900 m, 2 July 1985, *B. E. Hammel & M. H. Grayum 14096* (holotype, MO; isotype, CR). Figure 7.

Species notabilis appendicibus dorsalibus antherarum inflatis a speciebus mihi cognitiss bene distincta.

Perennial parts unknown, apparently somewhat woody, older stems glabrescent, lenticellate, young stems with mixed indumentum, long hairs spreading to somewhat reflexed, white or pale yellow, 0.5–

1.5 mm long, short hairs 0.1–0.2 mm long, internodes 1–30 cm. Leaf blades ovate or elliptic, $7.1\text{--}11.7 \times 3.2\text{--}7.5$ cm, apex acuminate, base truncate to lobate, lobes descending to convergent, sinus to 1.5 cm deep, pilose, hairs 0.5–1.2 mm long, lateral veins 5 to 8 pairs, middle veins $40^\circ\text{--}50^\circ$ to midrib, colleters 4 to 6; petiole 2.8–7.5 cm, with mixed indumentum, short hairs sometimes absent. Inflorescence congested-paniculiform, nearly umbelliform or interrupted, 5- to 13-flowered, with mixed indumentum, short hairs sometimes absent, peduncle 4–77 mm, pedicel 6–36 mm, bracts $0.8\text{--}2.5 \times 0.5\text{--}0.6$ mm, deltate; calyx tube ca. 1.2 mm long, with 0 or 1 colleter per sinus, lobes lanceolate with attenuate tips, $10\text{--}10.5 \times 2.5\text{--}3$ mm, green, hispidulose, hairs outside 0.4–0.6 mm long, hairs inside 0.1–0.2 mm long; corolla short-campanulate then rotate, green, hispidulose outside with hairs 0.2–0.3 mm long, inside hispidulose, hairs brown, 0.2–0.3 mm long proximally, becoming shorter distally, tube ca. 3.5 mm long, faucal annulus an erect, 5-lobed lip, with the same indumentum as the adjacent tube, lobes ca. 1 mm tall, corolla lobes ovate to elliptic, cucullate, rugose, with obtuse to asymmetrically acuminate tips, $7.5\text{--}7.7 \times 4.9\text{--}5.1$ mm, reflexed; gynostegium with stipe ca. 1×1.5 mm, 5-ribbed at tip, 5-winged at base, corona a thin, 5-lobed disk with 5 radial wings continuing from stipe wings, ca. 1.5 mm wide at lobes, 1 mm wide at sinuses, adnate for most of length to corolla, anther appendages sharply deflexed, fleshy, spatulate when flattened, distal-lateral margins thickened, concave between, proximal margins thin, overlapping with proximal margins of adjacent appendages and covering corpuscula, $1.5\text{--}1.7 \times 2.8\text{--}3$ mm in outline, apparently purple, terminal appendages loosely overlapping style apex, ca. 0.2×1.8 mm, guide rails vertical, straight, parallel, ca. 0.5×0.1 mm; corpusculum ca. 0.38×0.23 mm, sagittate, dark brown, translators ca. 0.25×0.19 mm, pollinia ca. 1×0.3 mm, sinuately obovate; style apex ca. 2.8 mm wide. Follicles ovoid, apex acute, base broad, at a right angle to follicle body, $9.5\text{--}13 \times 5\text{--}7$ cm, with 2 complete or nearly complete wings 0.7–1 cm wide and 1 or 2 smaller wing fragments, glabrous, minutely tuberculate; seeds obovate, $8.5\text{--}8.7 \times 4.4\text{--}5$ mm, pale brown with darker brown streaks, margin 0.6–0.8 mm wide, crenulate on distal two-thirds, surface inconspicuously verrucose, coma ca. 3 cm long, white.

The dorsal anther appendages of this species are unlike any yet recorded for the genus; they are apparently inflated in natural condition and dry with the appearance of crinkled varnish. This is exactly

the appearance of the dorsal appendages of *Fischeria* DC., but in that genus the dorsal appendages have grown to the point of subsuming the terminal anther appendages, while the terminal appendages of *Gonolobus grayumii* are still apparent, although thicker and more loosely attached than normal. Furthermore, *Fischeria* has abundant glandular hairs and smooth follicles, while *Gonolobus grayumii* lacks glandular hairs and has winged follicles. The first record of this species (*Tonduz 12185*) has been in collections for more than a century, but has only old inflorescences with all flowers fallen and young inflorescences with immature buds. It is curious that this original collection has short peduncles, up to 4 mm long, and more or less truncate leaf bases, while the two modern collections have peduncles 21–77 mm long and deeply lobate leaf bases, but otherwise the collections match well, including the several unique floral characters. The species has been found between 1390 and 1900 m elevation and has been collected in flower in May and July and with mature fruits in January and March.

Paratypes. COSTA RICA. **Puntarenas:** Buenos Aires, headwaters of Quebrada Dorora, 9 km NE of Ujarrás, *M. H. Grayum & A. Badilla 10268* (MO). **San José:** Au bord du Río Pedregoso au Copey, *A. Tonduz 12185* (BR, P, US). PANAMA. **Chiriquí:** S side of El Hato del Volcán, *M. Nee 14141* (MO, WIS).

8. *Gonolobus hadrostemma* W. D. Stevens, sp. nov. TYPE: Costa Rica. Puntarenas: Monteverde, 800 m, 29 Nov. 1980, *W. Haber 412* (holotype, MO). Figure 8.

Ex affinitate *Gonolobi calycosis* et specierum affinium corona ampla exserta, ex *G. hammelii* floribus minoribus pilis corollae brevioribus distinguenda.

Perennial parts unknown, young stems with sparse mixed indumentum, especially in the nodes, short hairs spreading, white with brown septa, 0.05–0.1 mm long, glandular hairs 0.05–0.1 mm long, internodes 10–18 cm. Leaf blades elliptic, $8.5\text{--}15.6 \times 3\text{--}6.4$ cm, apex acuminate to attenuate or occasionally apiculate, base abruptly and inconspicuously cordate, sinus 0.1–0.3 cm deep, adaxially glabrous or very sparsely puberulent with hairs 0.1 mm long, abaxially puberulent with hairs 0.2–0.3 mm long, lateral veins 6 to 11 pairs, middle veins $50^\circ\text{--}60^\circ$ to midrib, colleters 2 to 4; petiole 1.1–3.7 cm, with indumentum of stem. Inflorescence congested-racemiform, 2- to 6-flowered, with indumentum of stem, peduncle 1–2 mm, axis 0.5–4 mm, pedicel 7–14 mm, bracts $0.7\text{--}0.9 \times 0.3\text{--}0.4$ mm, deltate; calyx tube 0.5–0.7 mm long, with 1 colleter per sinus, lobes narrowly lanceolate to del-

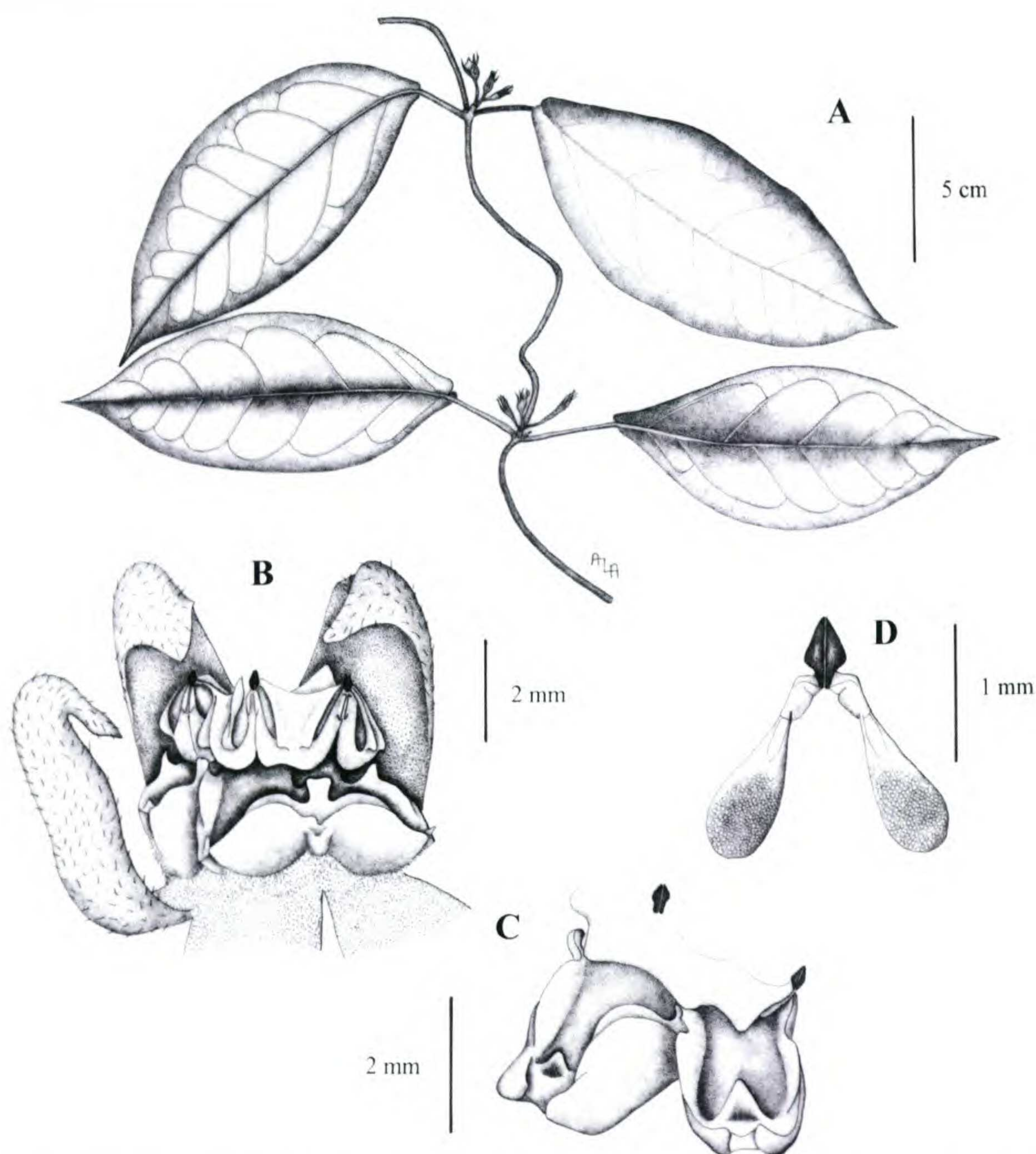


Figure 8. *Gonolobus hadrostemma* W. D. Stevens. —A. Flowering branch (Moreno 6411, MO). —B. Flower from side (Moreno 6411, MO). —C. Details of faucal annulus and corona (Moreno 6411, MO). —D. Pollinarium (Moreno 6260, MO).

tate, with acute tips, $5.5\text{--}10.3 \times 0.9\text{--}1.8$ mm, green or tinted purple, puberulent outside, glabrous inside; corolla rotate, cream or pale purple, distally puberulent outside with hairs $0.1\text{--}0.3$ mm long, inside uniformly hispidulose with white hairs $0.05\text{--}0.1$ mm long, tube $1\text{--}1.5$ mm long, faucal annulus an erect tube, 5-lobed, $0.7\text{--}1.2$ mm tall, lobes horizontal and adnate to the base of the corona, corolla lobes elliptic, with thickened margins, nearly valvate, distally somewhat cucullate (inflexed in bud), apex asymmetrically acute, $7.2\text{--}9.5 \times 3.7\text{--}4.7$ mm, reflexed; gynostegium with stipe $2.2\text{--}2.6 \times 2.8\text{--}3.2$ mm, with 5 wings entirely adnate to corona, corona fleshy, purple, bowl-shaped, $1.8\text{--}2.5$ mm tall, with 5 cucullate lobes alternating with 5 blunt knobs above stipe wings, base adnate to and largely cov-

ering the annulus, anther appendages obsolete, reduced to 2 fleshy, marginal ridges, terminal appendages loosely overlapping style apex, $0.6\text{--}0.7 \times 1.4\text{--}1.6$ mm, pale purple, guide rails straight, indistinct; corpusculum $0.45\text{--}0.55 \times 0.22\text{--}0.35$ mm, sagittate with tip curved outward, red-brown, translators $0.3\text{--}0.43 \times 0.2\text{--}0.28$ mm, pollinia $1.13\text{--}1.4 \times 0.55\text{--}0.6$ mm, nearly symmetrical; style apex $3\text{--}3.7$ mm wide. Fruits and seeds unknown; ovaries 5-ribbed, densely puberulent.

This species belongs to the group within *Gonolobus* originally described as *Trichostelma* Baillon. The group is characterized by having an erect, tubular faucal annulus and a corona that is almost entirely adnate to the inside of the annulus tube

and adnate to the gynostegium stipe by narrow wings, creating 5 deep nectaries. Additionally, the corolla lobes are only slightly overlapping and with inflexed tips in bud, resulting in corolla lobes that often have thickened margins, more or less symmetrical disposition of the indumentum, and are distally somewhat to distinctly cucullate. The anthers are oriented more to the margin of the gynostegium than under the style apex and the dorsal anther appendages that are a unique feature of *Gonolobus* are often reduced or even obsolete. This new species, and the related *Gonolobus hammelii* described below, differ from the others in having a massive corona that is exerted from and largely obscuring the annulus tube; the annulus is also more prominently lobed than in the other species of the group. In *Flora de Nicaragua* (Stevens et al., 2001: 251), this species was described as "*Gonolobus* sp. B."

Paratypes. NICARAGUA. **Granada:** Volcán Mombacho, arriba y SE de Hacienda Cutirre, *P. P. Moreno* 6260 (MO); Volcán Mombacho, Finca San Joaquín, *P. P. Moreno* 6411 (MO). **Rivas:** Volcán Maderas, *P. McGillivray* 86 (F).

9. *Gonolobus hammelii* W. D. Stevens, sp. nov.
TYPE: Costa Rica. Puntarenas: Canton de Osa, Valle del Térraba, fachada S de Fila Rentina, al N de Palmar Norte, Quebrada Benjamín, 8°59'N, 83°28'W, 300 m, 13 Dec. 1989, *B. E. Hammel & M. H. Grayum* 17699 (holotype, MO; isotypes, CR, MO). Figure 9.

Ex affinitate *Gonolobi calycosis* et specierum affinium corona ampla exserta, ex *G. hadrostemma* floribus majoribus pilis corollae longioribus distinguenda.

Perennial parts unknown, young stems glabrous except with very sparse mixed indumentum at the nodes, short hairs spreading, white with brown septa, 0.2 mm long, glandular hairs 0.1 mm long, internodes 12–25 cm. Leaf blades elliptic, paler below, 13.5–16 × 6.3–7 cm, apex acuminate, base abruptly and inconspicuously cordate, sinus 0.1–0.2 cm deep, adaxially glabrous, abaxially sparsely puberulent with hairs 0.1 mm long, lateral veins 10 to 11 pairs, middle veins 60°–70° to midrib, colleters 4 to 7, raised on a fleshy pad and somewhat connate; petiole 2.4–3.6 cm, glabrous. Inflorescence congested-racemiform, 2- to 4-flowered, with mixed indumentum of short and glandular hairs, peduncle 1–2 mm, axis 1–2 mm, pedicel 18–20 mm, bracts ca. 0.4 × 0.2 mm, deltate; calyx tube ca. 0.1 mm long, with 2 colleters per sinus, lobes narrowly lanceolate with acute tips, 7.5–7.9 × 1.6–1.7 mm, green with purple margins, with mixed in-

dumentum outside, glabrous inside; corolla rotate, deep purple-black, distally puberulent outside with appressed hairs 0.1 mm long, inside uniformly hispidulose with white hairs 0.5–0.8 mm long on tube and annulus and gradually decreasing to 0.2 mm long at tips of lobes, tube ca. 2.2 mm long, faucal annulus an erect tube, 5-lobed, 1.4–2.3 mm tall, lobes horizontal and adnate to the base of the corona, corolla lobes elliptic, with thickened margins, nearly valvate, distally slightly or not at all cucullate (slightly inflexed in bud), apex acute, 12–12.5 × 6.1–6.4 mm, reflexed; gynostegium with stipe ca. 0.7 × 1 mm, 5-ribbed, corona fleshy, purple, bowl-shaped, 1.5–3 mm tall, angularly 5-lobed, each lobe with small tooth directed toward gynostegium, base adnate to annulus, anther appendages obsolete, reduced to a fleshy pad on base of anther back, terminal appendages appressed to style apex, 0.3 × 1.8 mm, apparently pale purple, guide rails indistinct; corpusculum ca. 0.43 × 0.28 mm, sagittate with tip curved outward, red-brown, translators ca. 0.38 × 0.15 mm, pollinia ca. 1.16 × 0.71 mm, asymmetrical; style apex ca. 3.3 mm wide. Fruits and seeds unknown; ovaries 5-ribbed, glabrous.

This new species is most closely related and superficially quite similar to *Gonolobus hadrostemma*, but differs in significant details. The differences in the size, color, and indumentum of the flowers could be an artifact of the few known collections, but the nearly sessile gynostegium and the lack of the partitions connecting the corona and the gynostegium stipe are important distinctions.

10. *Gonolobus pallidus* W. D. Stevens, sp. nov.
TYPE: Mexico. Chiapas: near Laguna Ocotál Grande, ca. 25–30 km SE of Monte Líbano, 950 m, 12 Aug. 1954, *R. L. Dressler* 1655 (holotype, NY; isotype, US). Figure 10.

Amplitudine et forma florum *Gonolobo versicolori* aemulans, differt foliis fere glabris lobis corollae glaberrimis ecarosis.

Perennial parts unknown, young stems with mixed indumentum, most densely at the nodes and in 2 lines on internodes, nearly glabrous at mid-internode, long hairs pale yellow, sharply reflexed, 0.4–0.6 mm long, short and glandular hairs 0.05–0.1 mm long, internodes 3–18 cm. Leaf blades elliptic to obovate, bicolorous, 7.6–12.2 × 2.8–5 cm, apex acuminate, base acute, obtuse or rounded, adaxially glabrous or with a few hairs at base of midrib and margin, abaxially with erect short and glandular hairs 0.05–0.2 mm long, lateral veins 6 to 10 pairs, middle veins 60°–65° to midrib, col-

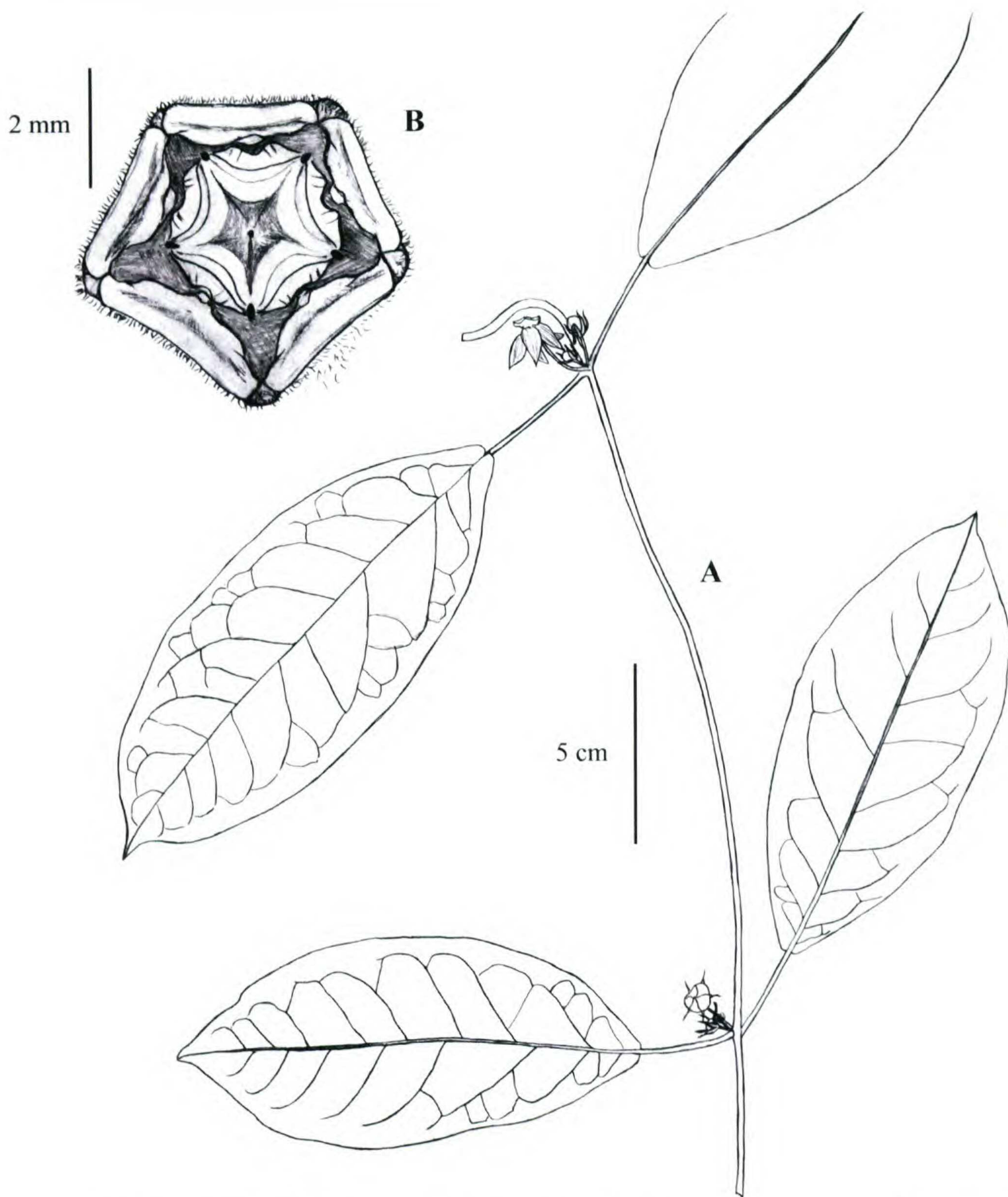


Figure 9. *Gonolobus hammelii* W. D. Stevens. —A. Flowering branch. —B. Gynostegium, corona, and faucal annulus, from above. Drawn from holotype (Hammel & Grayum 17699, MO).

leters 2; petiole 0.8–3 cm, with sparse and inconspicuous short and glandular hairs. Inflorescence racemiform to congested-racemiform, 3- to 12-flowered, glabrous, peduncle 23–42 mm, axis 0.2–1.3 mm, pedicel 37–61 mm, bracts 2–3 × 0.2–0.5 mm, deltate; calyx tube 0.8–1 mm long, with 1 colleter per sinus, lobes narrowly lanceolate with acute tips, 10.7–13.1 × 1.8–2 mm, green, glabrous; corolla briefly campanulate then rotate, pale green or yellow with a brown or purple tint, glabrous, tube 2.9–3 mm long, faucal annulus an erect tube, adnate to

base of corona and only visible as a 5-lobed flange on corona tube, 1–1.5 mm tall, corolla lobes narrowly lanceolate, with small auricles at the sinuses, 3–40 × 3.3–4.5 mm, apparently patent; gynostegium with stipe obconical, 1.6–2.5 × 1–2 mm, 5-ribbed, corona an erect, 5-lobed, fleshy, obconical tube, 2.4–3.5 mm tall from annulus to lobe tips, 1.6–3 mm tall at sinuses, anther appendages sharply deflexed, 2-armed, the arms curved outward and upward to vertical, forming a “W” on back of anther, 1.4–1.5 × 1.4–1.8 mm in outline in natural

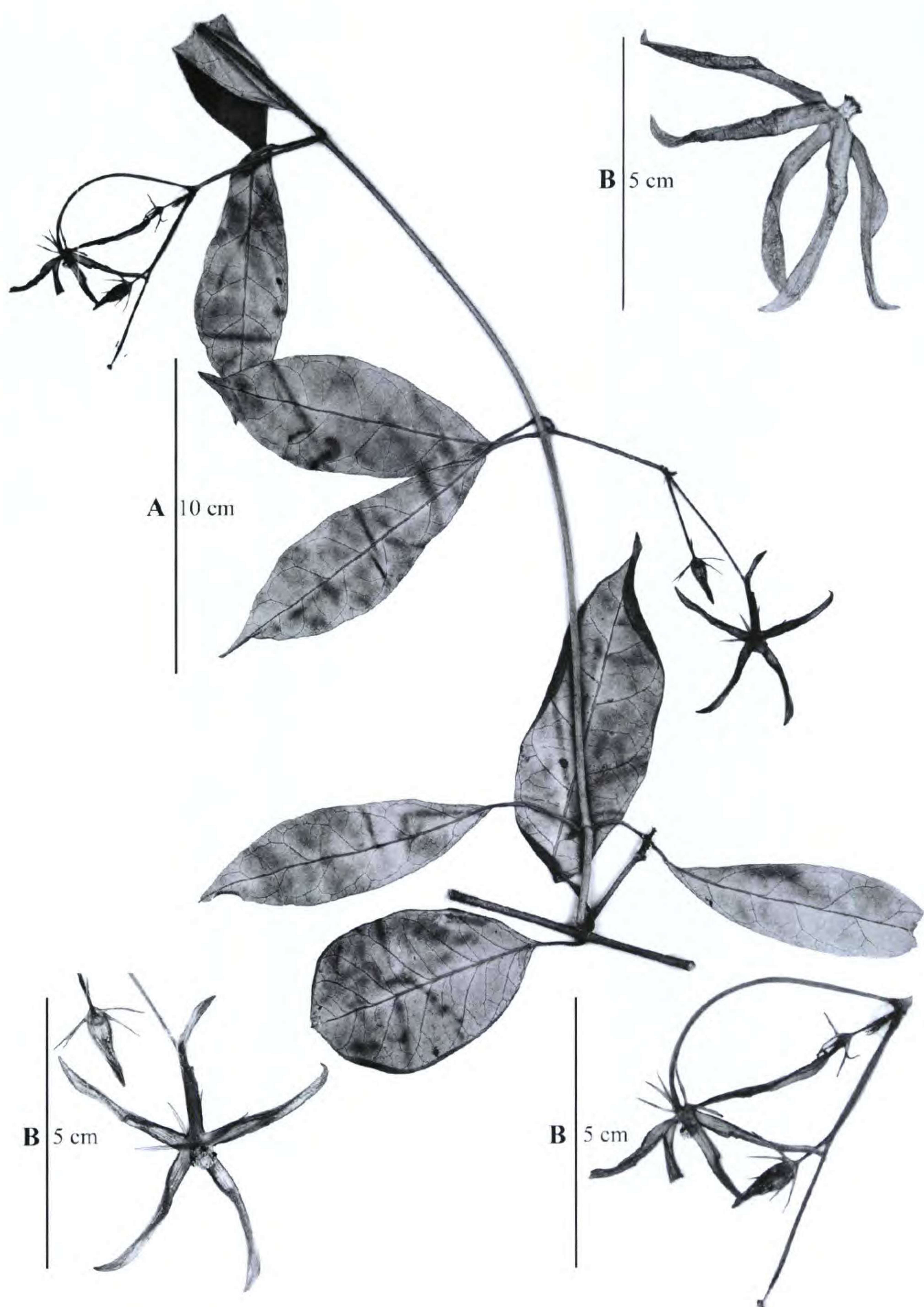


Figure 10. *Gonolobus pallidus* W. D. Stevens. —A. Scan of holotype (Dressler 1655, NY). —B. Close-up of flowers.

position, terminal appendages loosely overlapping margin of style apex, ca. 0.3 × 1.5 mm, apparently translucent, guide rails straight, parallel, 0.5–0.6 × 0.2–0.3 mm; corpuseculum 0.34–0.36 × 0.14 mm, sagittate, dark red-brown, translators ca. 0.33

× 0.16 mm, pollinia 0.71–0.73 × 0.34–0.36 mm; style apex 2.5–3 mm wide. Fruits and seeds unknown.

The flower size and shape of this species almost

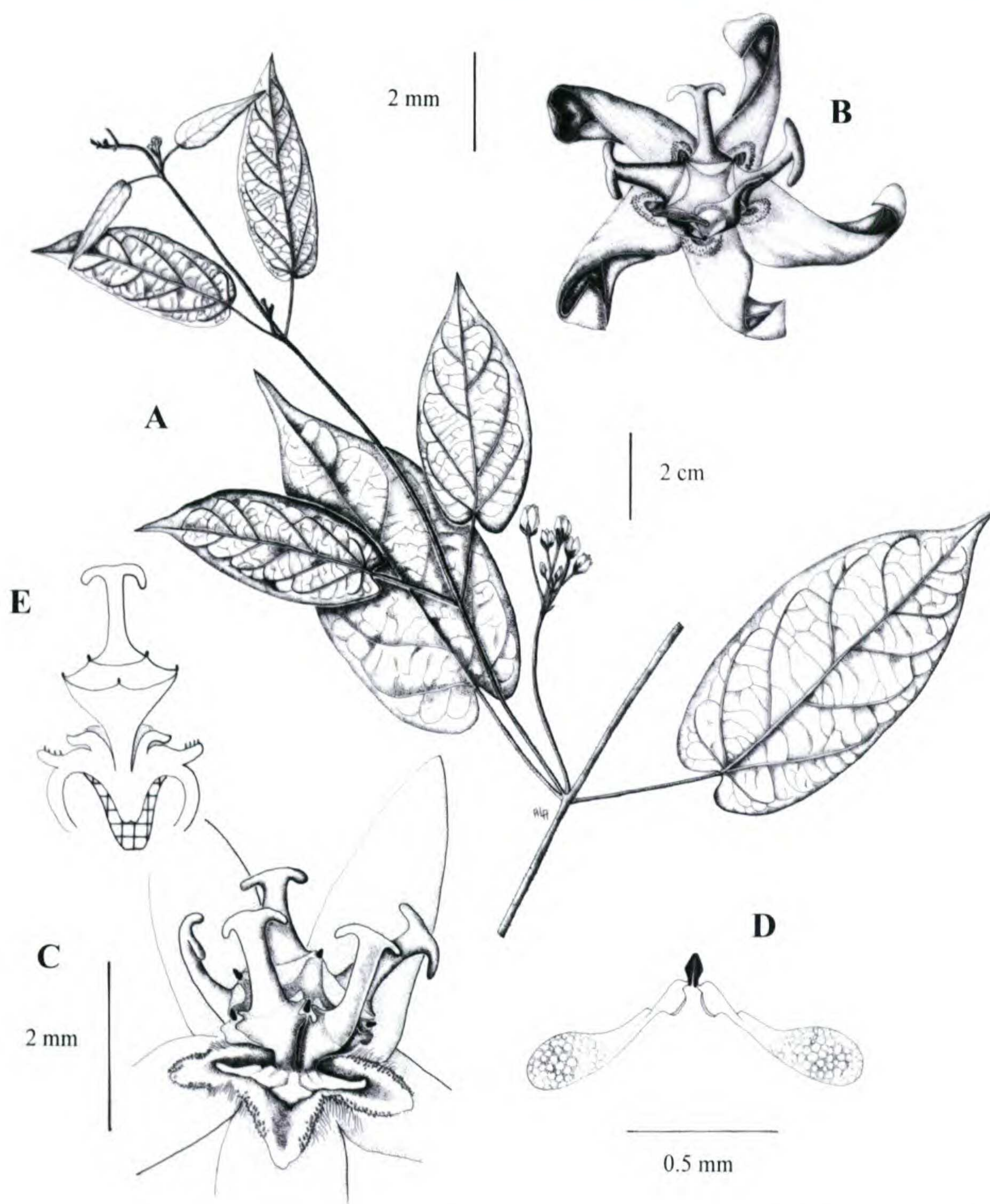


Figure 11. *Gonolobus sandersii* W. D. Stevens. —A. Flowering branch. —B. Flower, from above. —C. Flower, from side with corolla pulled back. —D. Pollinarium. —E. Diagnostic longitudinal section of flower. Drawn from *Sanders et al.* 8522 (MO).

exactly match those of *Gonolobus versicolor*, but otherwise the plants are quite different and the two species are probably not closely related; *G. pallidus* differs in having pale green, bicolored leaves that lack long hairs, an entirely glabrous corolla that has flat lobes, and dorsal anther appendages that are 2-armed rather than entire. The tubular annulus almost entirely adnate to the base of the much longer tubular corona is a unique character in the genus.

Paratype. MEXICO. **Chiapas:** Mpio. La Trinitaria, 10 km ENE of Dos Lagos above Santa Elena, *D. E. Breedlove* 52282 (CAS).

11. *Gonolobus sandersii* W. D. Stevens, sp. nov. TYPE: Mexico. Colima: Mpio. Comala, Rancho El Jabalí, around Lago Epazote, 19°26'30"N, 103°40'48"W, 1375 m, 2 Aug. 1991, *L. Vázquez V.* 974 (holotype, MO; isotype, UCR). Figure 11.

Species habitu cum *Gonolobo jaliscensi* optime congruens, sed differt appendicibus dorsalibus antherarum longioribus gracilioribus.

Perennial parts unknown, young stems with simple indumentum, denser at the nodes and \pm in 2 lines on internodes, hairs spreading or reflexed,

white to brown, 0.4–1.3 mm long, internodes 1–15 cm. Leaf blades elliptic, $5.7\text{--}9.9 \times 1.9\text{--}4.4$ cm, apex acuminate to attenuate, base lobate or rarely truncate, lobes descending to convergent, sinus to 0.6 cm deep, adaxially with sparse erect hairs 0.2–0.8 mm long, abaxially with brown glandular hairs ca. 0.1 mm long, especially on the nerves, and occasionally a few long hairs near base of midrib, lateral veins 4 to 7 pairs, middle veins $40^\circ\text{--}50^\circ$ to midrib, colleters 4 or 6; petiole 2.5–3.3 cm, with glandular hairs and often a few long hairs. Inflorescence congested-racemiform or sometimes interrupted, 1- to 20-flowered, puberulent with curly, non-glandular hairs ca. 0.1 mm long, uniformly or on 1 side, peduncle (2–)9–52 mm, axis 2–10 mm, pedicel 15–32 mm, thin and lax, bracts $1.2\text{--}2.2 \times 0.2\text{--}0.6$ mm, lanceolate or deltate; calyx tube 0.4–0.8 mm long, with 1 colleter per sinus, lobes deltate or ovate with acute to rounded tips, $1.4\text{--}2 \times 0.9\text{--}1.3$ mm, green or purple, abaxially with appressed hairs 0.1–0.15 mm long, adaxially glabrous; corolla campanulate, uniformly green, abaxially glabrous, adaxially pubescent on faucal annulus, tube, and base of lobes, hairs bright white, 0.1–0.2 mm long, hairs of outer lobes of annulus lobes curly, hairs of inner annulus lobes and corolla tube straight, tube 1.7–2.4 mm long, faucal annulus of 10 rounded lobes, lobes opposite corolla lobes erect or ascending, outer surface green and sparsely pubescent, inner surface white and densely pubescent, 1–1.6 mm long, alternate lobes sharply inflexed, white and densely pubescent, 0.4–0.9 mm long, corolla lobes elliptic with revolute margins and somewhat twisted, apex acute to rounded, $5.5\text{--}6.3 \times 1.8\text{--}2.4$ mm, reflexed; gynostegium with stipe 0.4–0.8 \times 0.8–1.2 mm, 5-ribbed, corona fleshy, white or margin sometimes brown, bowl-shaped, 10-lobed, each lobe with a central ridge, 0.9–1.2 mm wide at lobes opposite outer annulus lobes, 0.5–0.8 mm wide at alternate lobes, base adnate to annulus, anther appendages white, ascending, with a long, thin stalk and a bifid tip, stalk $1.5\text{--}3.2 \times 0.2\text{--}0.5$ mm, arms divergent to coiled, tip in natural outline $0.4\text{--}1 \times 0.7\text{--}1.2$ mm, terminal appendages appressed to style apex, $0.15\text{--}0.3 \times 0.9\text{--}1.3$ mm, bright white, guide rails indistinct, vertical, $0.1\text{--}0.3 \times 0.1$ mm; corpusculum $0.14\text{--}0.19 \times 0.06\text{--}0.08$ mm, subsagittate, red-brown, translators $0.16\text{--}0.24 \times 0.09\text{--}0.13$ mm, pollinia $0.5\text{--}0.64 \times 0.18\text{--}0.19$ mm, asymmetrical; style apex 1.5–2 mm wide, red-purple. Fruits and seeds unknown.

This new species is not apparently allied to any other. It is superficially most similar to *Gonolobus jaliscensis*, especially vegetatively and in the small

flowers with a strongly reflexed green corolla, and *G. sandersii* occurs at similar elevations within the range of *G. jaliscensis*, but *G. jaliscensis* is generally much more pubescent, including both sides of the corolla, has shorter and more rigid inflorescences, green-on-green reticulate corollas, and, most conspicuously, short, bilobed dorsal anther appendages. The anther appendages of *Gonolobus sandersii* are a more prominent part of the flower than any other species of *Gonolobus*, and on collectors' notes are sometimes called petals.

Paratypes. MEXICO. **Colima:** Mpio. Comala, Rancho Jabalí, S and E sides of Lago El Calabozo, A. C. Sanders, I. Garcia R., G. Ballmer & T. Krantz 8522 (MO, UCR), L. Vázquez V. & B. L. Phillips 889 (MO, UCR), 951 (MO, UCR), L. Vázquez V. 1084 (MO, UCR); Mpio. Comala, Rancho Jabalí, around Lago El Epazote, L. Vázquez V. & B. L. Phillips 725 (MO, UCR), L. Vázquez V. 1002 (MO, UCR), 1362 (MO, UCR). **Jalisco:** Mpio. Tecalitlán, 3 km al E de Llanitos, brecha a Canutillo, J. Villa C. & S. D. Koch 777 (CHAPA, MO).

12. *Gonolobus truncatifolius* W. D. Stevens, sp. nov. TYPE: Costa Rica. Limón: Cordillera de Talamanca, Atlantic slope, Valle de Silencio, just N of Cerro Hoffman, 4.5 airline km W of Panama border, $9^\circ08'N$, $82^\circ58'W$, 2350–2450 m, 8 Sep. 1984, G. Davidse, G. Herrera C. & M. H. Grayum 28625 (holotype, MO; isotype, CR). Figure 12.

Gonolobo chiriquensi proxima forma et amplitudine florum foliorumque sed differt praesertim indumento prominenti et nervis secundariis foliorum paucioribus.

Perennial parts unknown, young stems with dense simple or mixed indumentum, long hairs 0.5–2 mm long, pale yellow, reflexed to nearly patent, short hairs, when present, ca. 0.1 mm long, internodes 1–19 cm. Leaf blades elliptic or somewhat ovate or obovate, $6.3\text{--}10 \times 2.6\text{--}5$ cm, apex acuminate to attenuate, base rounded to truncate, pilose adaxially with hairs 0.4–1.5 mm long, midrib sometimes with short hairs, pilose or pilosulose abaxially with hairs 0.1–1.5 mm long, lateral veins 5 to 6 pairs, middle veins $40^\circ\text{--}60^\circ$ to midrib, colleters 2, long and thin and often with dark bases and light tips; petiole 1.5–3.9 cm, pilose, hairs antrorse. Inflorescence congested-racemiform, 2- to 4-flowered, with simple or mixed indumentum, peduncle 3–17 mm, axis ca. 0.2 mm, pedicel 5–18 mm, bracts $1.2\text{--}5 \times 0.4\text{--}1$ mm, lanceolate; calyx tube 0.5–1.5 mm long, with 0 to 2 colleters per sinus, lobes lanceolate to elliptic with acute tips, $6\text{--}7.8 \times 2.2\text{--}3.3$ mm, green, adaxially glabrous, abaxially pilosulose with hairs erect to appressed, 0.1–0.5 mm long; corolla rotate, purple or green

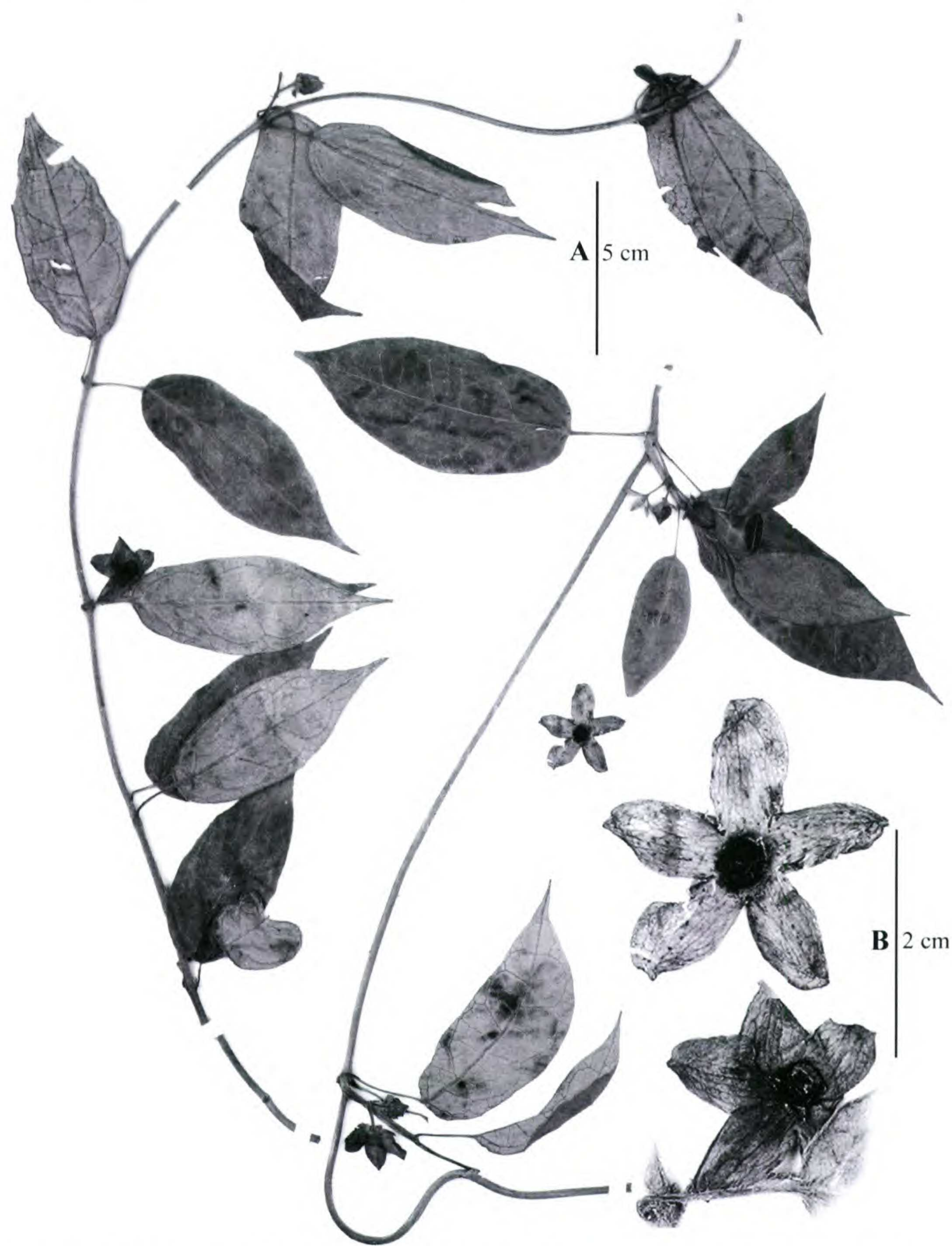


Figure 12. *Gonolobus truncatifolius* W. D. Stevens. —A. Scan of holotype (Davidse et al. 28625, MO). —B. Close-up of flowers.

with brown veins, abaxially pilosulose with hairs appressed to erect, 0.2–0.5 mm long, adaxially the tube, surface of annulus, and one margin of each lobe with curly white hairs 0.05–0.1 mm long, tube 2–3 mm long, faucal annulus an erect lip, 0.2–0.3

mm tall, upper margin without distinct hairs, lobes asymmetrically elliptic with asymmetrically obtuse tips, 9–12 × 7–8.4 mm, patent; gynostegium with stipe 0.3–0.5 × 1–1.3 mm, 5-ribbed, corona a 5-lobed disk, fleshy and deeply rugose, each lobe

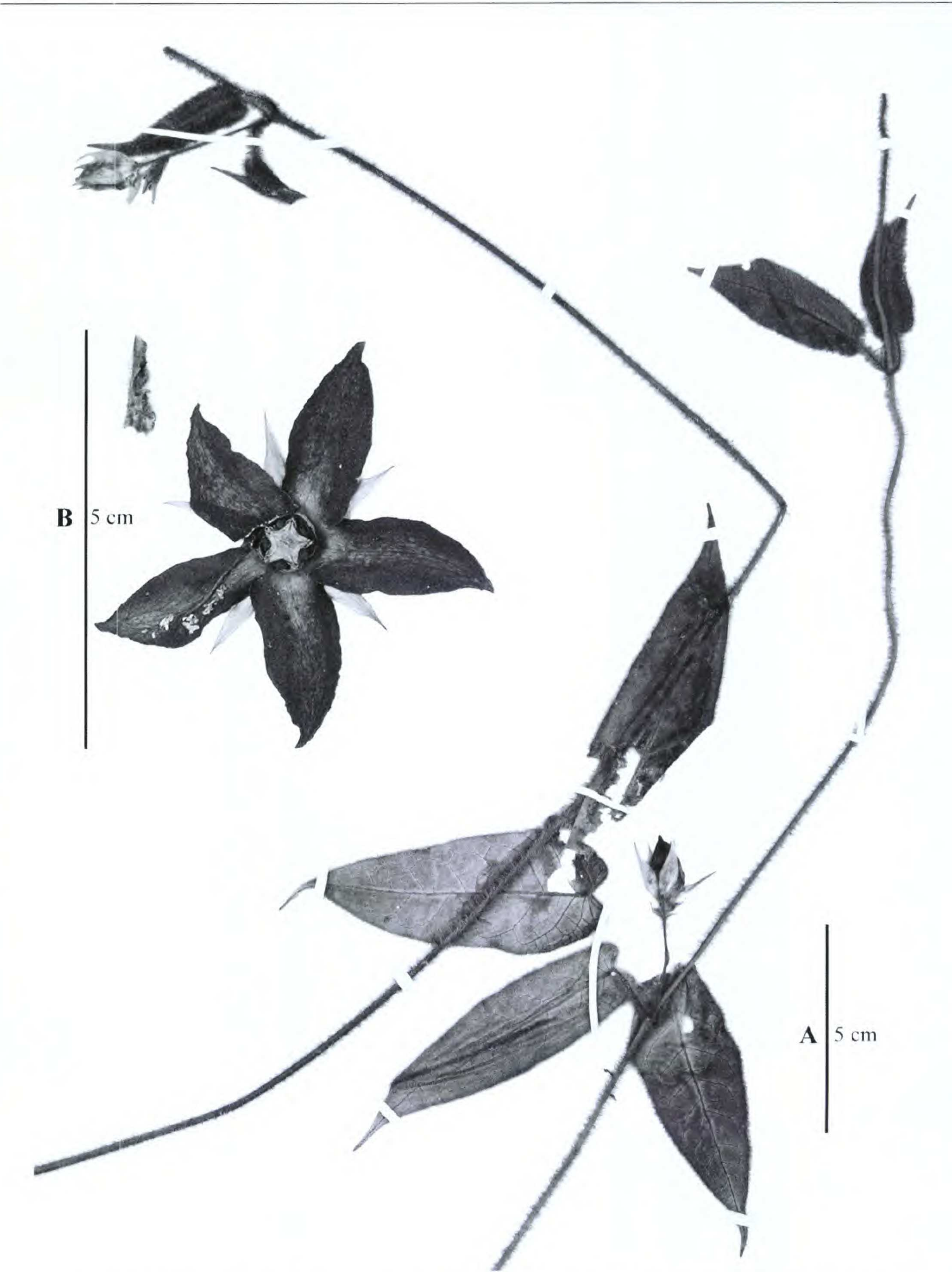


Figure 13. *Gonolobus ustulatus* W. D. Stevens. —A. Scan of holotype (Gómez 11413, F). —B. Close-up of flowers.

somewhat cucullate and retuse at tip, outer margin deeply striate, 1.4–2.5 mm wide at lobes, 1.1–2 mm wide at sinuses, anther appendages deflexed, with a broad, rounded base and an obdeltate tip, apex shallowly 3-lobed to shallowly crenulate, 0.7–0.9 mm long, 0.9–1.3 mm wide at tip, somewhat fleshy, terminal appendages tightly appressed to style apex, 0.2–0.5 × 2–2.2 mm, brown, guide rails straight, parallel, indistinct, nearly vertical, ca. 0.2 × 0.1 mm; corpusculum 0.26–0.3 × 0.1–0.15 mm,

sagittate, red-brown to nearly black, with a hooked tip, translators $0.24\text{--}0.25 \times 0.14\text{--}0.15$ mm, pollinia $0.83\text{--}0.94 \times 0.31\text{--}0.34$ mm, sigmoidally obovate; style apex $3\text{--}3.3$ mm wide. Immature follicles fusiform, apex acute, base narrowed, at a right angle to follicle body, ca. 9.5×2.5 cm, with 5 complete wings ca. 5 mm wide, glabrous, glaucous; seeds unknown.

This new species is clearly closest to *Gonolobus chiriquensis* Woodson, found in similar habitats in Costa Rica and Panama. The two share generally similar leaf size and shape, especially the more or less truncate leaf bases, and generally similar flower size and shape, especially the short, broad, strongly asymmetrical corolla lobes that are reminiscent of many species of *Matelea* Aublet. There are, however, a number of striking differences. *Gonolobus chiriquensis* is practically glabrous on all parts while *G. truncatiflorus* is conspicuously villose, notably including the outside of the corolla, the new species has 5 to 6 secondary leaf veins (vs. 8 to 14), and the style apex is $3\text{--}3.3$ mm in diameter (vs. $1.6\text{--}2$ mm). The corona of *Gonolobus truncatifolius* is much more massive and produces a white mucilage when soaked in water, perhaps indicating that it is secreting something other than nectar and a phenomenon not seen in other species.

This is a cloud forest species known from 1500 to 2750 m, among the highest elevations known for *Gonolobus*. It is known to flower in July, September, and December, and the immature fruits were collected in September.

Paratypes. COSTA RICA. **Heredia:** P. N. Braulio Carillo, de la Est. Barva 1 km hacia Laguna Barva, *G. Rivera* 409 (INB, MO). **Puntarenas:** R. I. Ujarrás, R. B. Dúrika, *Q. Jiménez & R. Aguilar* 1946 (INB, MO). **San José:** P. N. Chirripó, camino a Chirripó, *E. Alfaro* 989 (INB, MO).

13. *Gonolobus ustulatus* W. D. Stevens, sp. nov.
TYPE: Costa Rica. Alajuela: R. F. San Ramón, $10^{\circ}13'N$, $84^{\circ}37'W$, 900–1200 m, 12–15 Mar. 1987, *J. Gómez L. 11413* (holotype, F). Figure 13.

Gonolobo leiantho maxime similis sed caulibus foliis inflorescentiis ferrugineis pilosis lobis calyces longioribus angustioribus corollis intra tantum papillatis.

Perennial parts unknown, young stems with dense mixed indumentum, long hairs 2–2.5 mm long, brown, short and glandular hairs ca. 0.1 mm long, internodes 22–25 cm. Leaf blades narrowly elliptic to ovate, $7\text{--}8 \times 2.3\text{--}3$ cm, apex attenuate, base lobate, lobes descending, sinus 0.3–0.4 cm deep, pilose with brown hairs 1–1.5 mm long, lat-

eral veins 10 to 12 pairs, middle veins ca. 60° to midrib, colleters 2, with dark bases and light tips; petiole 1.4–2 cm, with mixed indumentum. Inflorescence congested-racemiform, 2-flowered, with mixed indumentum, peduncle 22–25 mm, pedicel (immature) 3–8 mm, bracts $3.6\text{--}8 \times 0.8\text{--}1$ mm, lanceolate; calyx tube ca. 0.8 mm long, with 1 colleter per sinus, lobes lanceolate with acute tips, $14\text{--}15 \times 3.2\text{--}3.4$ mm, green, adaxially glabrous, abaxially with mixed indumentum, long hairs brown, erect, 1–1.5 mm long; corolla rotate, green, reticulate, abaxially glabrous or with a few hairs at tips of lobes, adaxially with tube and a broad band along one margin of each lobe papillate, tube ca. 5 mm long, faucal annulus a thin, erect lip, ca. 0.3 mm tall at lobes, 0.1 mm tall at sinuses, hispidulose with white hairs ca. 0.1 mm long, corolla lobes narrowly asymmetrically elliptic with asymmetrically acute tips, with inconspicuous auricles at the sinuses, $20\text{--}21 \times 9\text{--}10$ mm, patent; gynostegium with stipe ca. 1×1.5 mm, 5-winged, corona a 5-lobed disk, the 5 wings of the stipe continuing as radii on the corona, ca. 3.5 mm wide, papillate, outer margin vertically striate, anther appendages slightly deflexed, asymmetrically reniform, ca. 1.4×2.3 mm in outline, fleshy, brown, terminal appendages tightly appressed to style apex, ca. 0.3×3.2 mm, translucent white, guide rails straight, parallel, indistinct, tilted under style apex, ca. 0.2×0.1 mm; corpusculum ca. 0.43×0.18 mm, sagittate, dark red-brown, with a hooked tip, translators ca. 0.34×0.24 mm, pollinia ca. 1.66×0.48 mm, \pm symmetrical, fertile (distal) body with a distinct longitudinal ridge on one face; style apex ca. 4.5 mm wide, green. Fruits and seeds unknown.

In technical characters, this imperfectly known new species is probably closest to *Gonolobus leianthus* Donnell Smith, a species ranging from southern Mexico to northern Nicaragua, but is quite different in general appearance because all parts except the flowers are covered with long brown hairs. Additionally, the new species can be recognized by having narrower leaves with more secondary veins, longer and narrower calyx lobes, corolla lobes merely papillate and lacking a white callus, and a papillate corona.

14. *Gonolobus variabilis* W. D. Stevens, sp. nov.
TYPE: Costa Rica. Puntarenas: NE slope of Fila de Cal, along road between San Vito de Coto Brus and Ciudad Neily, $8^{\circ}41'00''N$, $82^{\circ}56'30''W$, 620 m, 7 Mar. 1987, *M. H. Grayum & C. Fleming 8118* (holotype, MO). Figure 14.

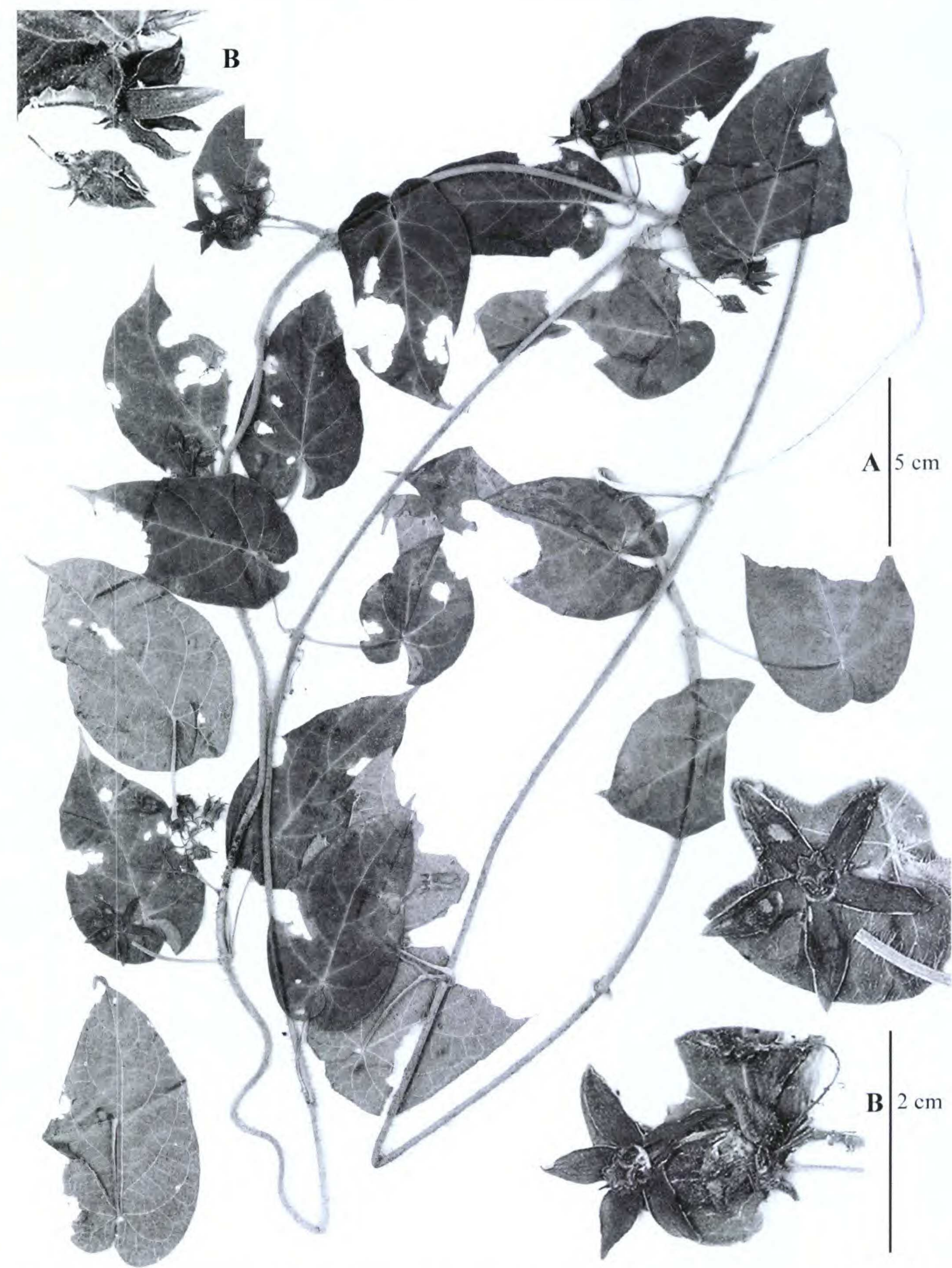


Figure 14. *Gonolobus variabilis* W. D. Stevens. —A. Scan of holotype (Grayum & Fleming 8118, MO). —B. Close-up of flowers.

A *Gonolobo albomarginato* floribus minoribus trichomatibus corollae extus intusque brevioribus, a *G. eduli* corolla atrovirenti callis loborum corollarum trichomatibus corollae extus longioribus trichomatibus corollae intus brevioribus recedit.

Perennial parts unknown, young stems with dense mixed indumentum, somewhat organized into 2 lines in internodes, long hairs 1–2.5 mm long, yellow to brown, short and glandular hairs 0.1–0.2

mm long, internodes 3–18 cm. Leaf blades elliptic to ovate, $8.5\text{--}13.5 \times 4.6\text{--}8.4$ cm, apex acuminate to attenuate, base lobate, lobes descending to overlapping, sinus 1–2 cm deep, sparsely pilose adaxially with hairs 0.3–1 mm long, midrib also with short and glandular hairs, abaxially with mixed indumentum, long hairs 0.2–1 mm long, lateral veins 6 to 8 pairs, middle veins $35^\circ\text{--}50^\circ$ to midrib, colleters 2 to 6, often with dark bases and light tips; petiole 2.9–7.7 cm, with mixed indumentum. Inflorescence congested-racemiform, 2- to 10-flowered, with mixed indumentum, peduncle 6–30 mm, axis 0.1–0.6 mm, pedicel 15–45 mm, bracts $0.7\text{--}5.6 \times 0.2\text{--}0.7$ mm, linear; calyx tube 0.7–1 mm long, with 1 colleter per sinus, lobes lanceolate with acute tips, $5.3\text{--}6 \times 1.2\text{--}2$ mm, green with purple tint, adaxially glabrous or with a few hairs on distal midrib, abaxially with mixed indumentum, long hairs erect, 0.4–0.8 mm long; corolla briefly campanulate and then rotate, green, abaxially with sparse to dense, simple or mixed indumentum, long hairs 0.2–1 mm long, adaxially with tube and proximal third to half of lobes hispidulose or papillate with white hairs to 0.05 mm long and with a band of curly white hairs 0.2–0.4 mm long immediately along white callus of lobes, tube 1.5–2 mm long, faucal annulus erect, 0.5–1 mm tall, hispidulose with white hairs 0.2–0.4 mm long, lobes narrowly lanceolate or elliptic with acute tips, with conspicuous auricles at the sinuses, one margin of each lobe with a thick, bright white callus, $9\text{--}14.1 \times 3.1\text{--}4.8$ mm, patent; gynostegium with stipe $1\text{--}1.5 \times 0.7\text{--}1.8$ mm, 5-winged, corona a 5-lobed, fluted bowl, the 5 wings of the stipe continuing as radii on the corona and forming 5 chambers, 0.8–1.8 mm tall at lobes, 0.5–1.4 mm tall at sinuses, anther appendages deflexed, reniform to nearly spatulate, with the broad apex shallowly crenulate, $1.2\text{--}2.4 \times 1.8\text{--}2.5$ mm in outline, fleshy, pale yellow to pale pink, terminal appendages tightly appressed to style apex, $0.1\text{--}0.2 \times 1.8\text{--}2.4$ mm, white to pale brown or purple, guide rails straight, parallel, indistinct to prominent, vertical to tilted under style apex, $0.1\text{--}0.7 \times 0.1\text{--}0.2$ mm; corpusculum $0.26\text{--}0.33 \times 0.1\text{--}0.11$ mm, sagittate, brown or red-brown, with a hooked tip, translators $0.31\text{--}0.39 \times 0.18\text{--}0.19$ mm, pollinia $1.05\text{--}1.38 \times 0.36\text{--}0.46$ mm, fertile (distal) body distinctly flattened or concave on one face; style apex 2.6–4 mm wide, pale yellow. Fruits and seeds unknown.

While this species is easily characterized by a series of characters, especially the indumentum of

the corolla, and unlike any other known *Gonolobus*, it is at the same time curiously variable. Two of the collections have long peduncles and two short, three have the outside of the corolla with a dense mixed indumentum while one has only scattered long hairs, three have pale yellow dorsal anther appendages and in one they are pale pink, two have distinctly larger style apices, and three have normal, indistinct, 0.1–0.2 mm long guide rails under the style apex and one has prominent, nearly vertical guide rails about 0.7 mm long. One could invent this species by combining characters from *Gonolobus albomarginatus* (Pittier) Woodson, *G. edulis* Hemsley, and *G. heterophyllus* (Hemsley) W. D. Stevens, and perhaps hybridization has been involved, but the four known collections are temporally and geographically separated and easily recognized. *Gonolobus albomarginatus*, *G. taylorianus* W. D. Stevens & Montiel, and *G. fraternus* Schlechtendal, among Mesoamerican species, are at least equally variable.

This is a cloud forest species known from 620 to 1300 m and is known to flower between November and March.

Paratypes. COSTA RICA. **Alajuela:** R. B. Monteverde, Peñas Blancas, W. Haber & E. Bello 6535 (MO); La Peña, A. Smith P2154 (MO). **San José:** Río Claro valley below La Palma NE of San Jerónimo, W. C. Burger & R. L. Liesner 6260 (F).

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